AMERICAN MACHINIST

SEPTEMBER 3, 1942

ARMAMENT: Production of Aircraft Manifolds—Page 959

Keeps Production Rolling

GRINDS 24 HOLES IN AIRCRAFT DRIVE ASSEMBLIES

Aircraft drive assemblies have 12 pairs of .875" diameter holes, 24 in all, which require grinding. In order to grind all of these holes in a single setup Heald Factory Engineering Service designed an indexing fixture for the job. In addition they recommended a grinding wheel sufficiently long to permit grinding a pair of holes simultaneously. By this method it is possible to grind each pair of holes dead-in-line and by indexing to obtain close center distances between holes.

THE HEALD MACHINE CO. WORCESTER, MASS., U. S. A.

MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES

AMERICAN MACHINIST

September 3, 1942

Exhausts Aloft—Thin sections and precision are combined in the aircraft manifolds made by Ryan Aeronautical

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PRINTED IN U. S. A.

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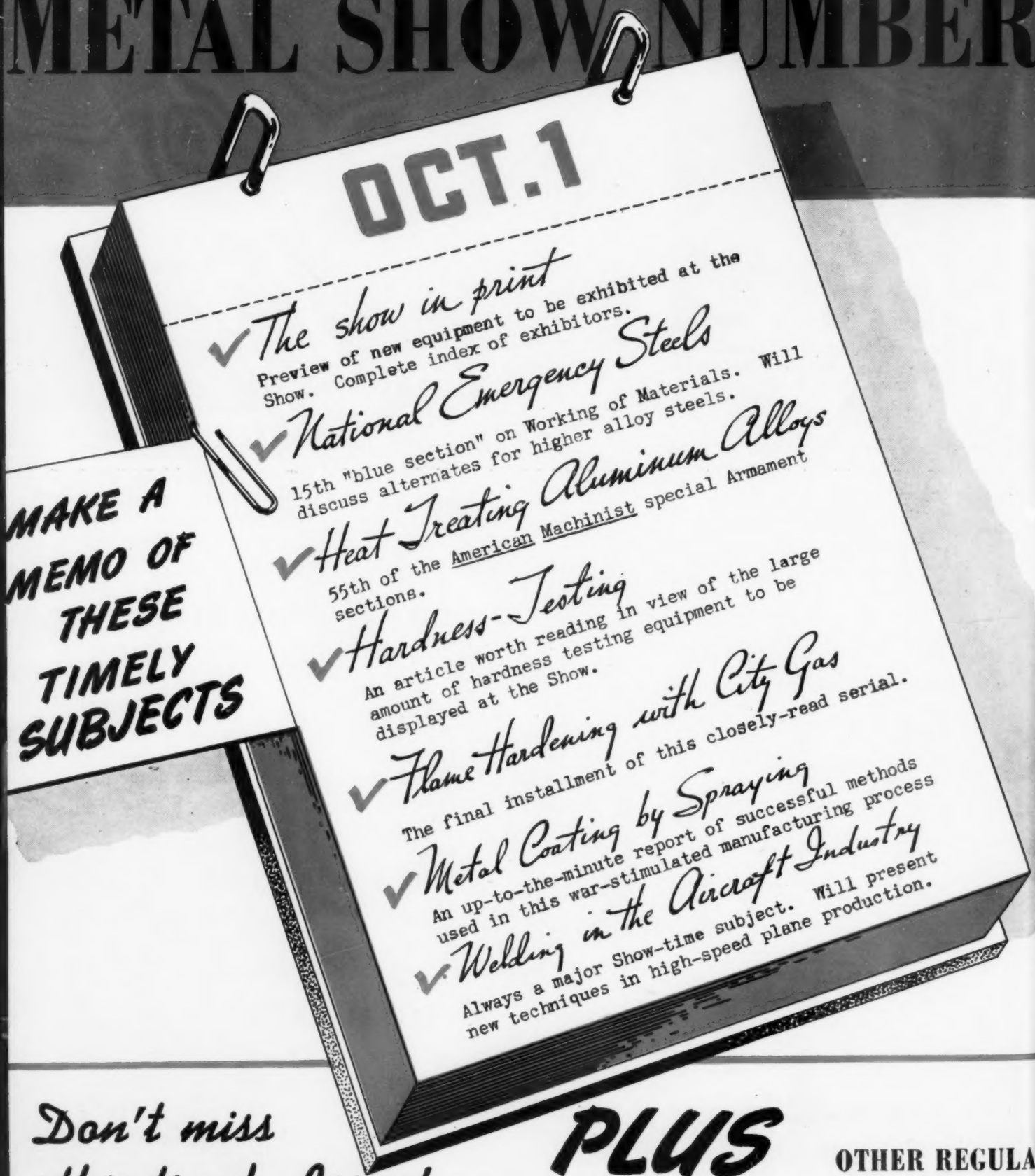
R v.86 5 S-O 1942

...it's on the way!

American Machinist's Wartime

METAL SHOW NUMBER

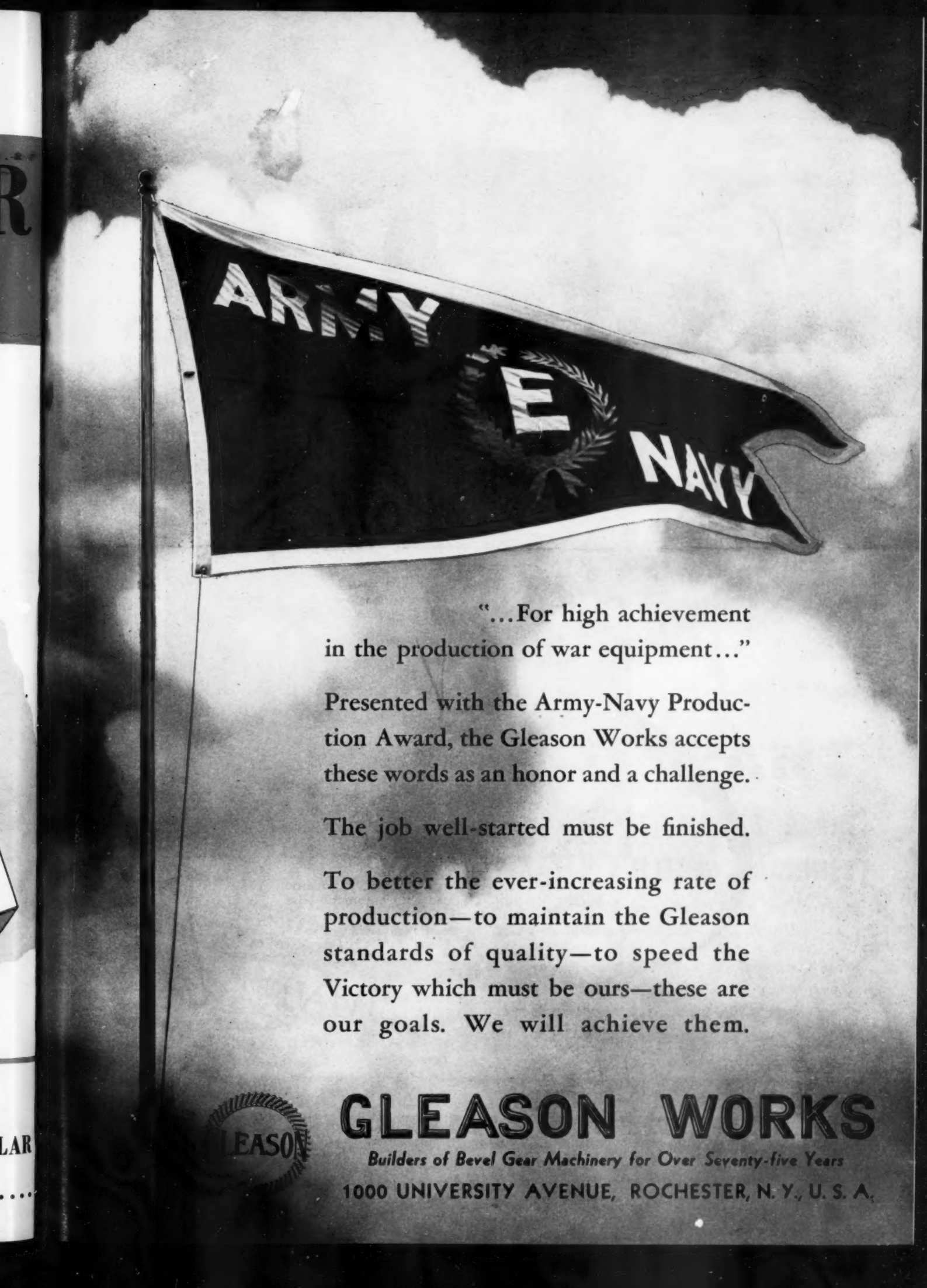

OCT. 1
✔ The show in print
Preview of new equipment to be exhibited at the Show. Complete index of exhibitors.
✔ National Emergency Steels
15th "blue section" on Working of Materials. Will discuss alternates for higher alloy steels.
✔ Heat Treating Aluminum Alloys
55th of the American Machinist special Armament sections.
✔ Hardness-Testing
An article worth reading in view of the large amount of hardness testing equipment to be displayed at the Show.
✔ Flame Hardening with City Gas
The final installment of this closely-read serial.
✔ Metal Coating by Spraying
An up-to-the-minute report of successful methods used in this war-stimulated manufacturing process
✔ Welding in the Aircraft Industry
Always a major Show-time subject. Will present new techniques in high-speed plane production.

MAKE A MEMO OF THESE TIMELY SUBJECTS

Don't miss this timely Issue!

PLUS OTHER REGULAR AND SPECIAL EDITORIAL FEATURES....

Tech



"...For high achievement in the production of war equipment..."

Presented with the Army-Navy Production Award, the Gleason Works accepts these words as an honor and a challenge.

The job well-started must be finished.

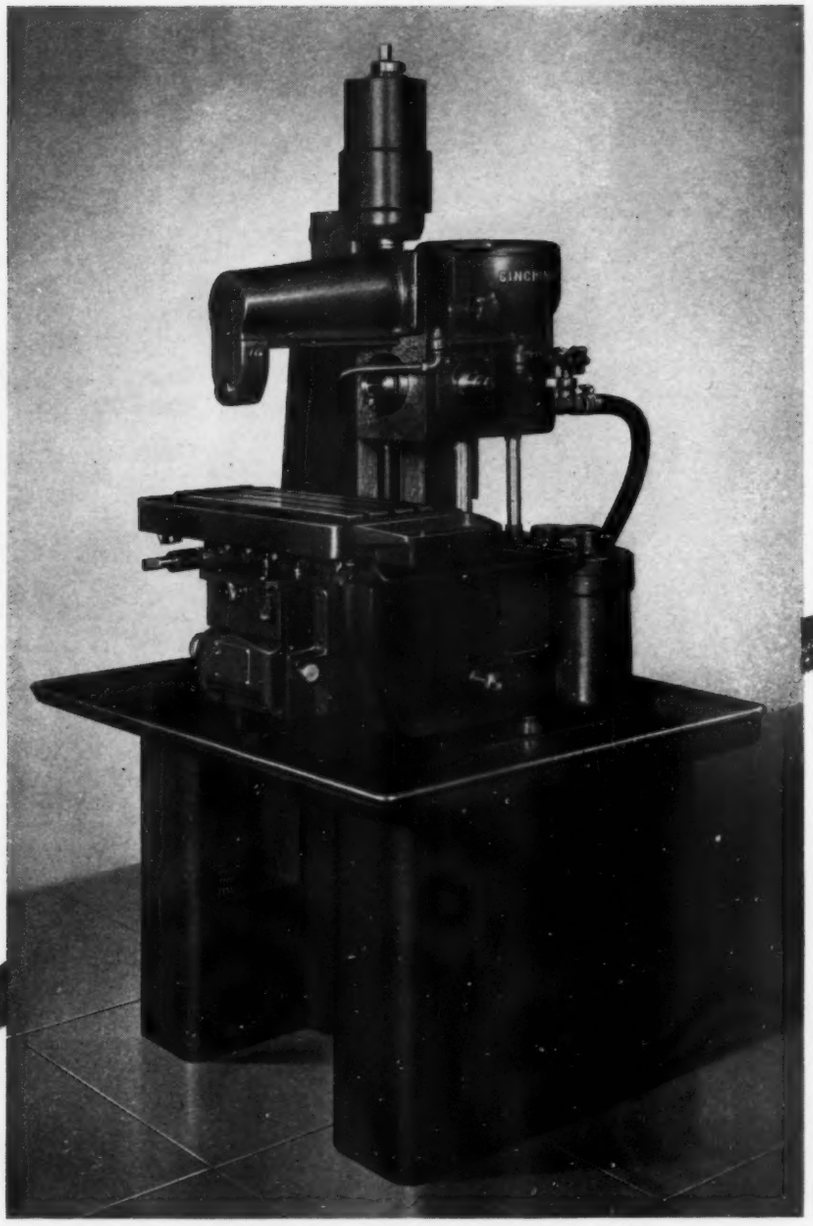
To better the ever-increasing rate of production—to maintain the Gleason standards of quality—to speed the Victory which must be ours—these are our goals. We will achieve them.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.



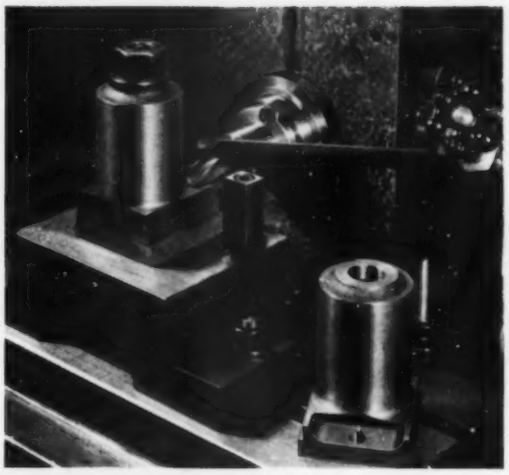
The CINCINNATI No. 0-8 Plain Automatic Milling Machine equipped with automatic Rise and Fall Spindle Carrier.

WIN *with a Cincinnati!*

THE CINCINNATI MILLING MACHINE CO.

Cincinnati, Ohio U. S. A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES
SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES



The 0-8 equipped with automatic Rise and Fall Spindle Carrier is especially desirable for milling operations where it is not possible for the work to traverse directly into the cut as illustrated.

IF IT'S LESS IDLE TIME YOU WANT

BUY CINCINNATI NO. 08 PLAIN AUTOMATIC MILLING MACHINES

Is idle machine time interfering with your production? During this emergency all sorts of machines have been put into service; good, bad, new, old — some easy to handle — many so tough they wear a man down, dampen his enthusiasm and break his spirit. Put a man on a machine that's hard to manipulate, and he soon begins to lag, takes time off in spite of his patriotism.

But, give him a machine he enjoys operating — a machine that turns out work he's proud of—a machine that doesn't wear him out and he'll work 40, 50, 60 or more hours a week and do it gladly. He's enthusiastic because he is doing something he thoroughly enjoys. He gets a kick out of operating his machine and is proud of the product it produces.

Such a machine is the CINCINNATI No. 0-8 Plain Automatic Milling Machine.

Operators like the 0-8 because it's completely automatic; it's simple and easy to handle, and it doesn't leave them worn out at the end of the shift. You'll like the 0-8 because it mills a wide range of small parts speedily, accurately and economically. It is an extremely flexible and dependable milling machine, capable of increasing your small parts production by greatly reducing idle machine time.

Specification catalog M-964 giving complete information on all features and their benefits will be sent on request. Send for your copy of this catalog today.

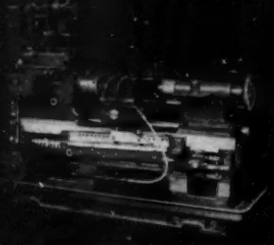
THE SECRET WEAPON THAT WILL WIN THIS WAR!

THERE it is . . . an incredible fact. In a Model 1906 Cadillac Automobile is the secret weapon that will win this war!

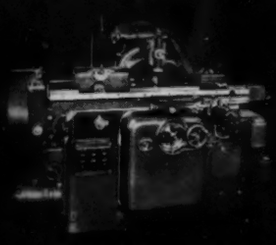
In 1906, Henry Martyn Leland shipped three Cadillac cars to England. In the presence of officials of the Royal Automobile Society, mechanics completely disassembled those three cars, heaped the parts together in a giant potpourri, mixed them thoroughly —and then, out of the heap, assembled three complete cars again, to the very austere amazement of the Royal Automobile Society. . . . The three cars were then put through a gruelling 500-mile test, and came through triumphantly.

Thus, 36 years ago an American-made car—built by the Interchangeable, or *American* System of manufacturing—was the first automobile in the world to win the respect of Europeans who had declared that good motor cars could only be built by hand!

In this little fact, hidden in the ancient chassis and motor of a 1906 American-made car, is the secret weapon that will win this war . . . the American System of manufacturing!



FAY AUTOMATIC LATHES



AUTOMATIC THREAD GRINDERS

OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

THE SECRET WEAPON THAT WILL WIN THIS WAR!

WITHOUT the greatest machine tool industry in the world, the automobile industry as we know it—and the American System of manufacturing—could never have developed to our present world-leading standards.

Starting with the interchangeable manufacture of gun parts, shown at the Crystal Palace, London, in 1851, long before the birth of the automobile, Robbins and Lawrence and its direct successor, Jones & Lamson, have developed and improved the precision machine tools that have helped to make that industry's growth possible.

As a result, instruments and machines designed by this company are today in the front line of the greatest single war-producing industry on earth. And it is because of this achievement in designing precision machine tools through more than a century of the company's history, that Jones & Lamson engineers are so well qualified for consultation on your present and post-war problems.

JONES & LAMSON MACHINE COMPANY

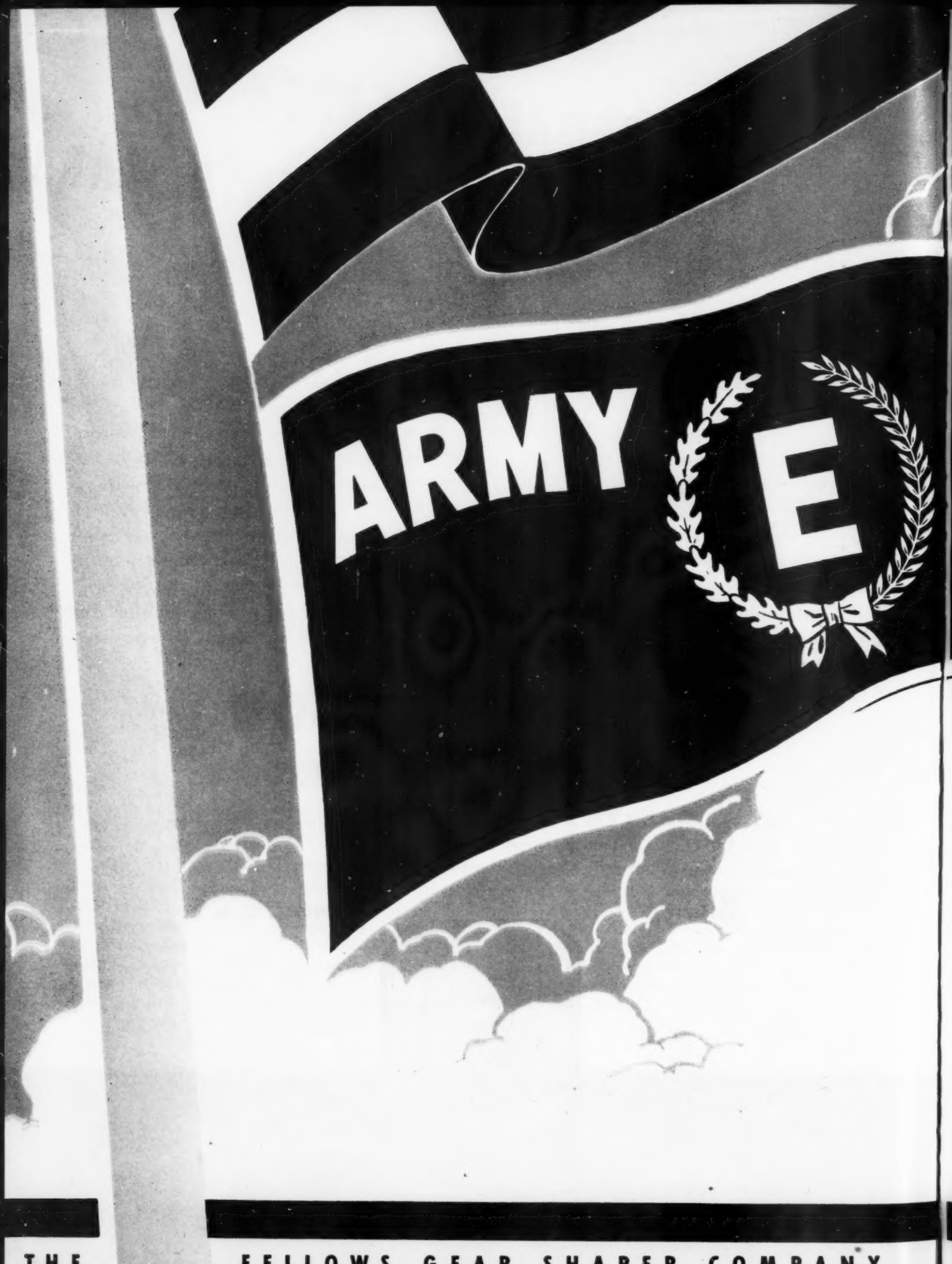
Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

Springfield, *Vermont,* U. S. A.

PROFIT PRODUCING
MACHINE TOOLS

SADDLE TYPE
UNIVERSAL TURRET LATHE

RAM TYPE
UNIVERSAL TURRET LATHE



THE FELLOWS GEAR SHAPER COMPANY

FOR EXCELLENCE IN PRODUCTION

Flying aloft to join Old Glory atop the Fellows plant, there waves a pennant which proclaims to one and all that Fellows has been presented the ***ARMY-NAVY AWARD.****

It is a tribute to the heritage which our hardy forefathers bequeathed to the men of the Green Mountain State. Here you find craftsmen mechanics who know how to design and build those Fellows machines which are so urgently needed to produce gears and other parts better and faster, for furthering the War Program.

Typically American, we here at the Fellows plant are meeting seemingly impossible production schedules, so that our boys on the firing line may be adequately supplied with the necessary tools of war.

Nothing can stop a united nation with the spirit and the determination to win. ***LET'S GO AMERICA!*** There is no ceiling on production.

**Presentation was made jointly by the Army and Navy, August 24, 1942*

FELLOWS

SPRINGFIELD, VERMONT, U. S. A.

IF IT'S LESS

CINCINNATI

CINCINNATI Hydraulic Universal Grinding Machines are available in 12", 14", 16", and 18" swings; between-center distances up to 72". There is a size to meet all your toolroom grinding and general manufacturing work. Specification catalogs G-486 and G-474 give complete details on all features and their benefits. Send for copies of these informative books today.

WIN *with a Cincinnati!*

IDLE TIME ★ ★ ★

YOU WANT

. . . BUY CINCINNATI HYDRAULIC UNIVERSAL GRINDING MACHINES

Mechanics enjoy operating CINCINNATI Hydraulic Universal Grinding Machines because these fine, precision grinders have taken the drudge out of work.

Machines that wear operators down may be responsible for many unnecessary idle machine hours in the form of absenteeism. When the CINCINNATI Hydraulic Universal was designed, the matter of convenient operation and ease of handling was given a great deal of attention. Every element of manipulation plays its part in the reduction of operator fatigue.

Much of the productivity of Hydraulic Universals may be attributed to the fact that they *are* easy to operate — controls are handy and effortless—they're precise, sensitive and positive. That's why the men are so enthusiastic about CINCINNATI Hydraulic Universals.

You'll be enthusiastic, too, for they assure Faster Set-Up, Faster Handling, Faster Grinding and Faster Sizing. They're exceedingly accurate — tolerances of .0002" being practical and easily achieved while maintenance expense is so low it ceases to be a consideration.

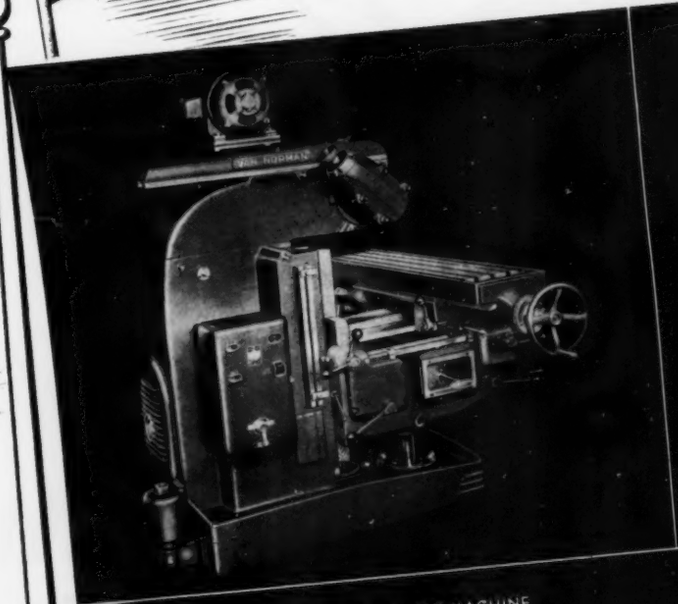
CINCINNATI GRINDERS INCORPORATED

Cincinnati, Ohio U. S. A.

CENTER TYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES

Van Norman

WITH PLUS-PRODUCTION OF THESE



NO. 26 RAM-TYPE MILLING MACHINE

NO. 22-L RAM-TYPE MILLING MACHINE

VAN NORMAN HAND MILL

NO. 620 OSCILLATING RADIUS GRINDER FOR BALL BEARING RACEWAYS

...will keep it flying

AND ALL OTHER VAN NORMAN MACHINES

NO. 2-L HORIZONTAL MILLING MACHINE

NO. 2-S HORIZONTAL MILLING MACHINE

NO. 3-V VERTICAL MILLING MACHINE

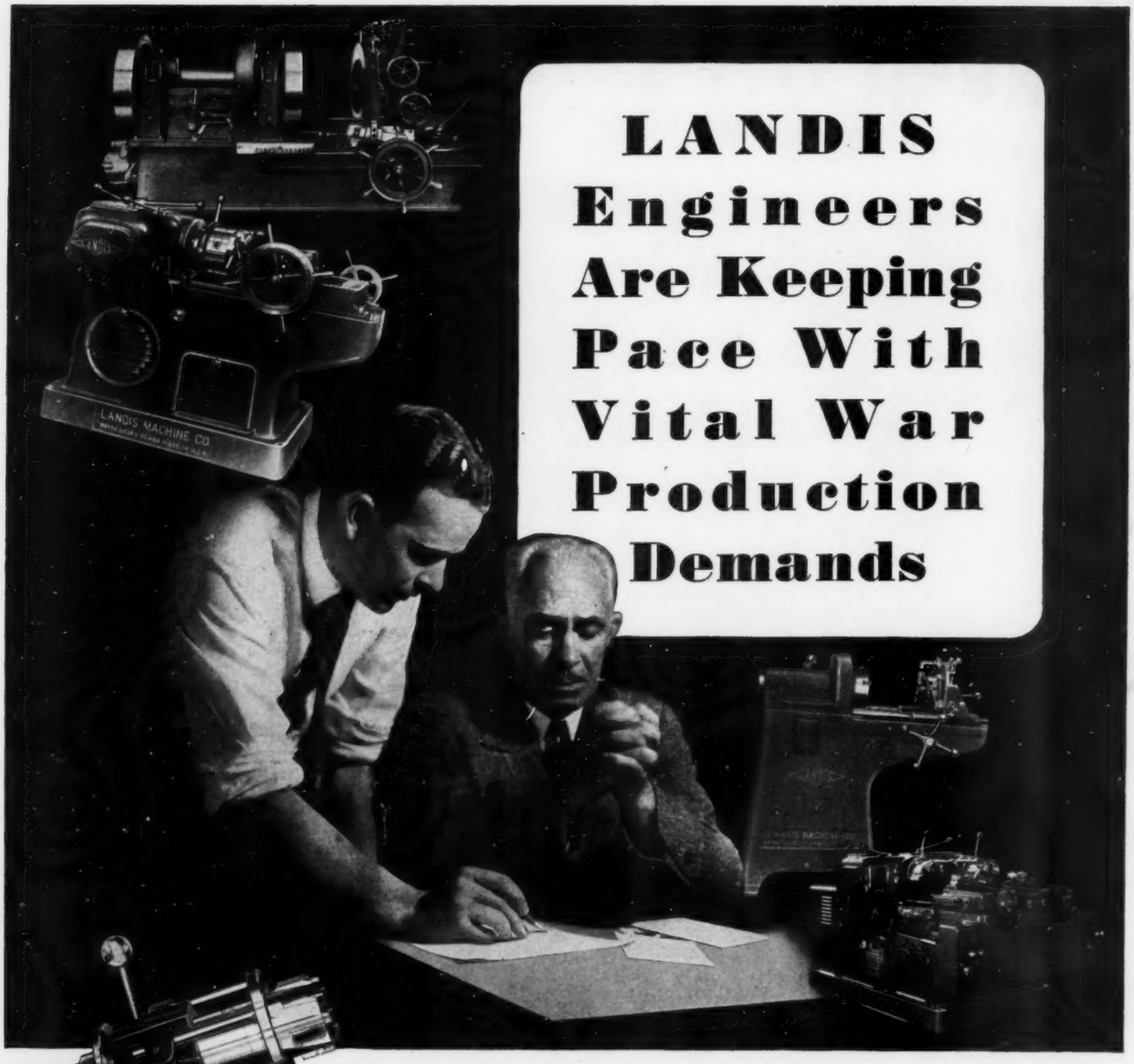
NO. 10-C CONTOUR MILLING MACHINE

PER-FECT-O BORING BARS FOR RECONDITIONING CYLINDERS OF INTERNAL COMBUSTION ENGINES

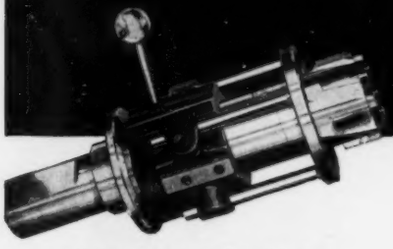
PISTON GRINDERS FOR ALL TYPES OF PISTONS IN INTERNAL COMBUSTION ENGINES

The Army and Navy Production Award will continue to be fully earned, seven days a week, by every one of the many hundreds of Van Norman men and women who are working to put production farther and farther ahead of schedule . . . on all Van Norman machine tools being built for war production and for the maintenance of motorized equipment on active service.

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD, MASS.



LANDIS Engineers Are Keeping Pace With Vital War Production Demands



LANDIS Style LT Collapsible Tap

The LANCO Head

More Production—Greater Accuracy is uppermost in the minds of LANDIS Engineers as they methodically streamline the LANDIS LINE—gearing it to the war effort.

Odd machine sizes are eliminated, old type Heads discontinued—New Machines standardized and geared to higher speeds—all without sacrifice in efficiency for the user—in an effort to keep pace with vital War Production demands.

LANDIS REG. U.S. TRADE MARK PAT. OFF.

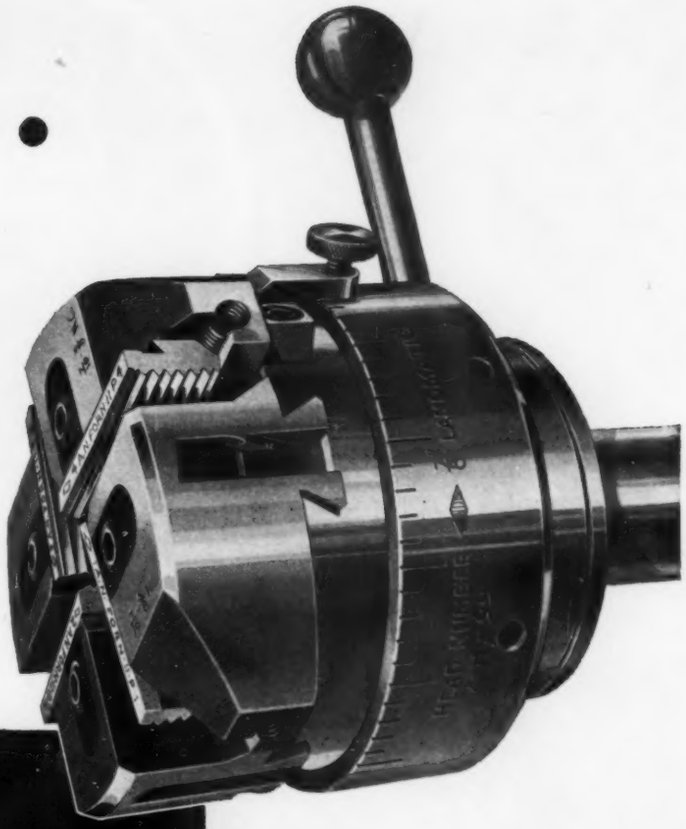
LANDIS MACHINE COMPANY
WAYNESBORO, PENNA., U. S. A.

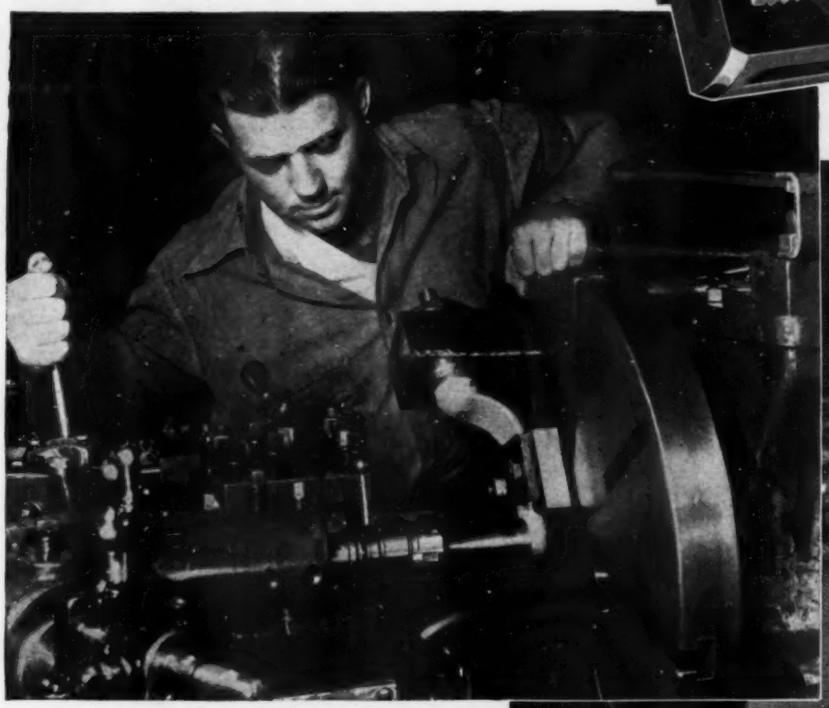
THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

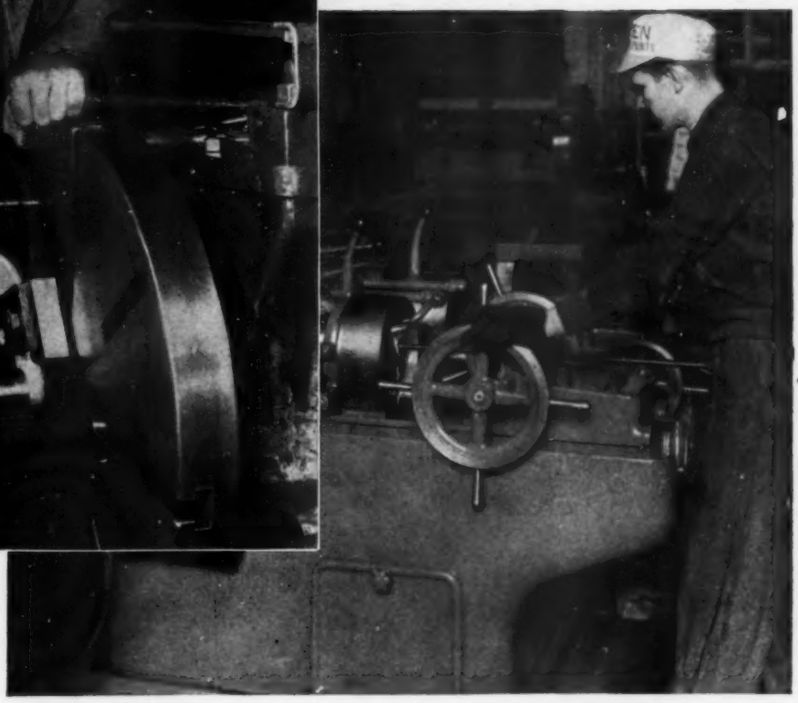
LANDIS . .

THREADING EQUIPMENT WILL SOLVE YOUR PRODUCTION PROBLEMS

In all kinds of Industry—everywhere—LANDIS Die Heads and Threading Machines are setting the pace in the production of Threaded Components used in the manufacture of Vital War Matériel.





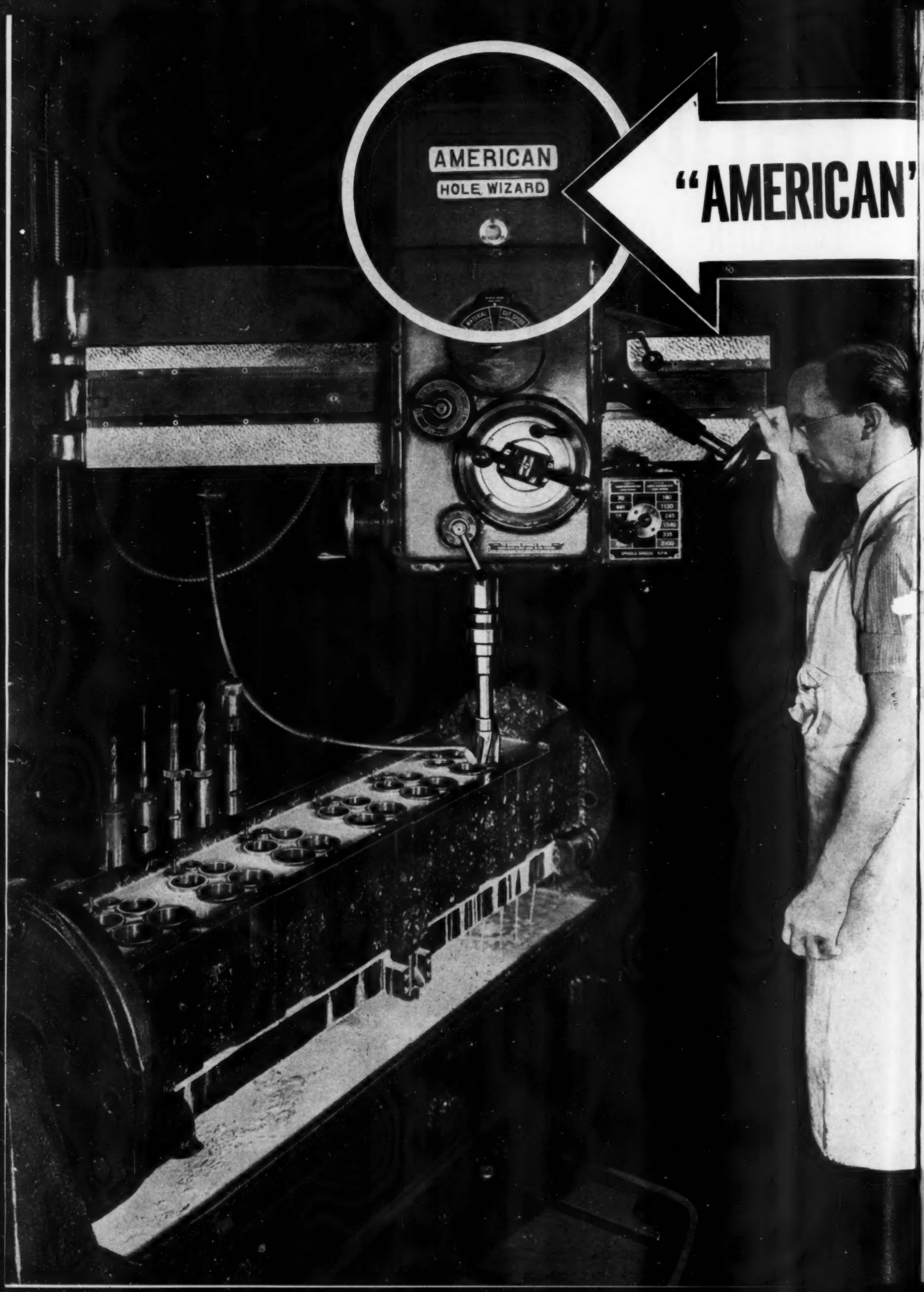


Write for Bulletin No. F-80-3 descriptive of the LANDMATIC Hardened and Ground Heads.

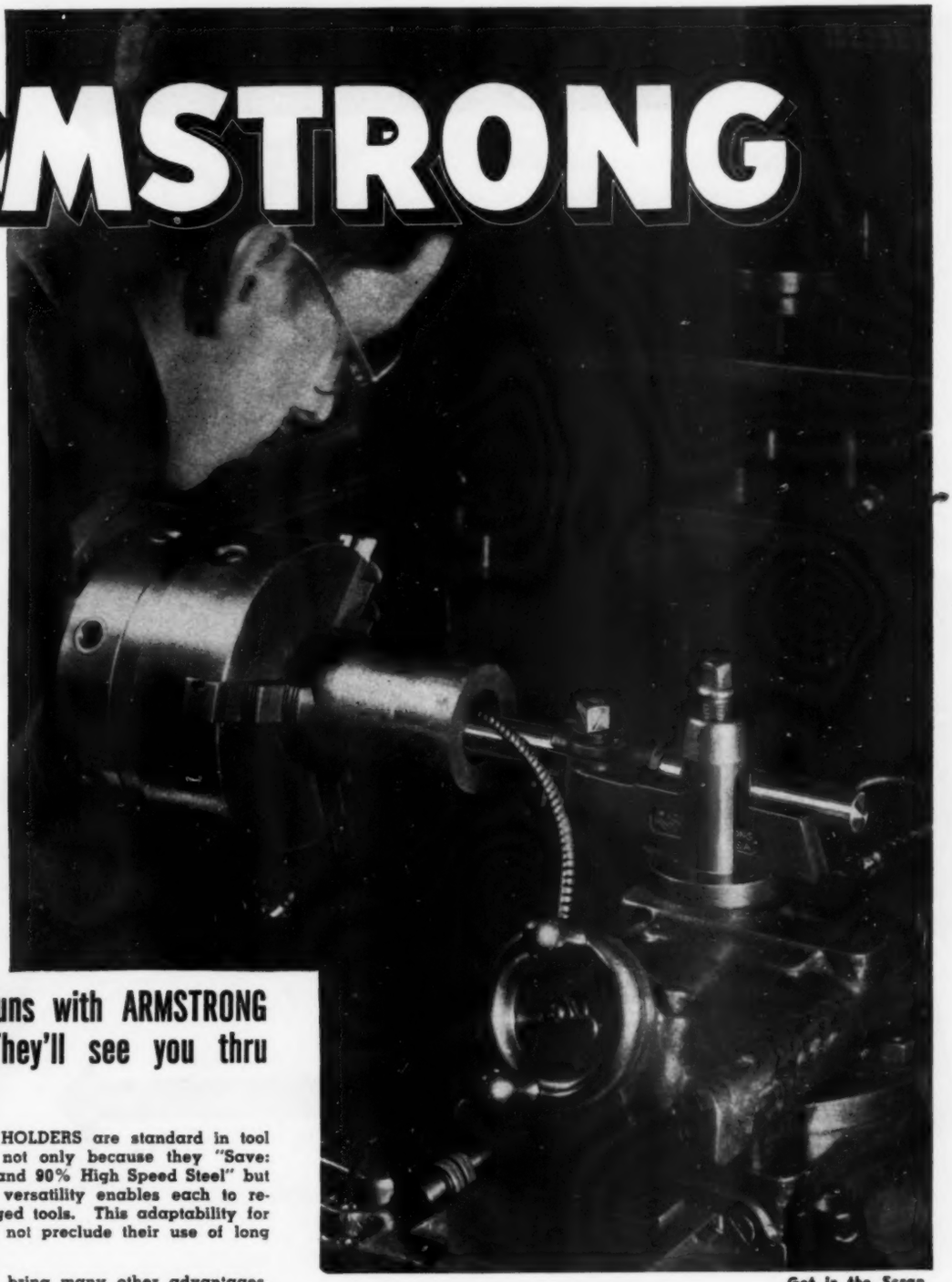
LANDIS MACHINE COMPANY
WAYNESBORO, PENNA., U. S. A.

LANDIS
REG. U.S. TRADE ~ MARK PAT. OFF.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS


AMERICAN
HOLE WIZARD
"AMERICAN'

ARMSTRONG



Start Production Runs with ARMSTRONG TOOL HOLDERS—They'll see you thru the longest runs.

While ARMSTRONG TOOL HOLDERS are standard in tool rooms and machine shops not only because they "Save: All Forging, 70% Grinding and 90% High Speed Steel" but also because their extreme versatility enables each to replace a complete set of forged tools. This adaptability for "short run" operations does not preclude their use of long run production work.

To the production line they bring many other advantages. In tooling up for long production runs ARMSTRONG TOOL HOLDERS should be used wherever possible because: They are accurately designed to give maximum cutting efficiency with maximum tool clearance. They have strength to stand up to any cutting speed or to any feed. They will carry on thru any run regardless how great—many are still in use after 10, 15 or 20 years of almost continuous operation. They make critical high speed steel stock go farther—an ounce of high speed steel in an ARMSTRONG TOOL HOLDER will machine as much metal as 10 ounces in a forged tool.

Use ARMSTRONG TOOL HOLDERS and ARMSTRONG TURRET LATHE and SCREW MACHINE TOOLS not only in tool rooms and machine shops but wherever possible for long production runs. They will always see you thru.

Get in the Scrap it's needed now!

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. Francisco Ave., Chicago, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

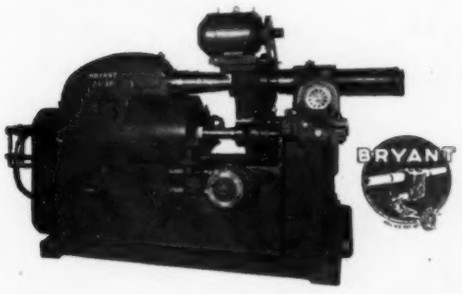
Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

PUBLIC LIBRARY
DETROIT MICH.

Bryant

WHEN your desk is snowed under with problems, production plans and blueprints, pull up a chair for Bryant. Every phase of a new job that relates to internal grinding is a phase that interests Bryant. Every angle and opportunity whereby time, money, stock or operations can be saved on these phases is a chance for Bryant to help you.



Bryant productive capacity has already been trebled and is constantly increasing to aid war production. Bryant engineering service has also been stepped up — stepped up not only to meet the urgent needs of armament, but the equally vital problem of planning new products that can be made economically and sold at a profit when peace returns once more.

This is an added reason for the forward-looking executive to "pull up a chair for Bryant."

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

EMERGENCY HELP ON MILLING PROBLEMS

. . . GET SUGGESTIONS ON SPEED-UPS . . . SHORT CUTS . . . THE USE OF ACCESSORIES AND ATTACHMENTS . . . FROM THE EMERGENCY PRODUCTION SERVICE DEPARTMENT AND FIELD MEN OF KEARNEY & TRECKER

Now — when top production is demanded — when every milling machine in your plant must deliver the most in performance — the skill and experience of Kearney & Trecker field representatives can be of great service and practical help on your milling problems.

Located in the principal cities of the United States and Canada, these men function as a national network for service and counsel under the direction of our Emergency Production Service Department.

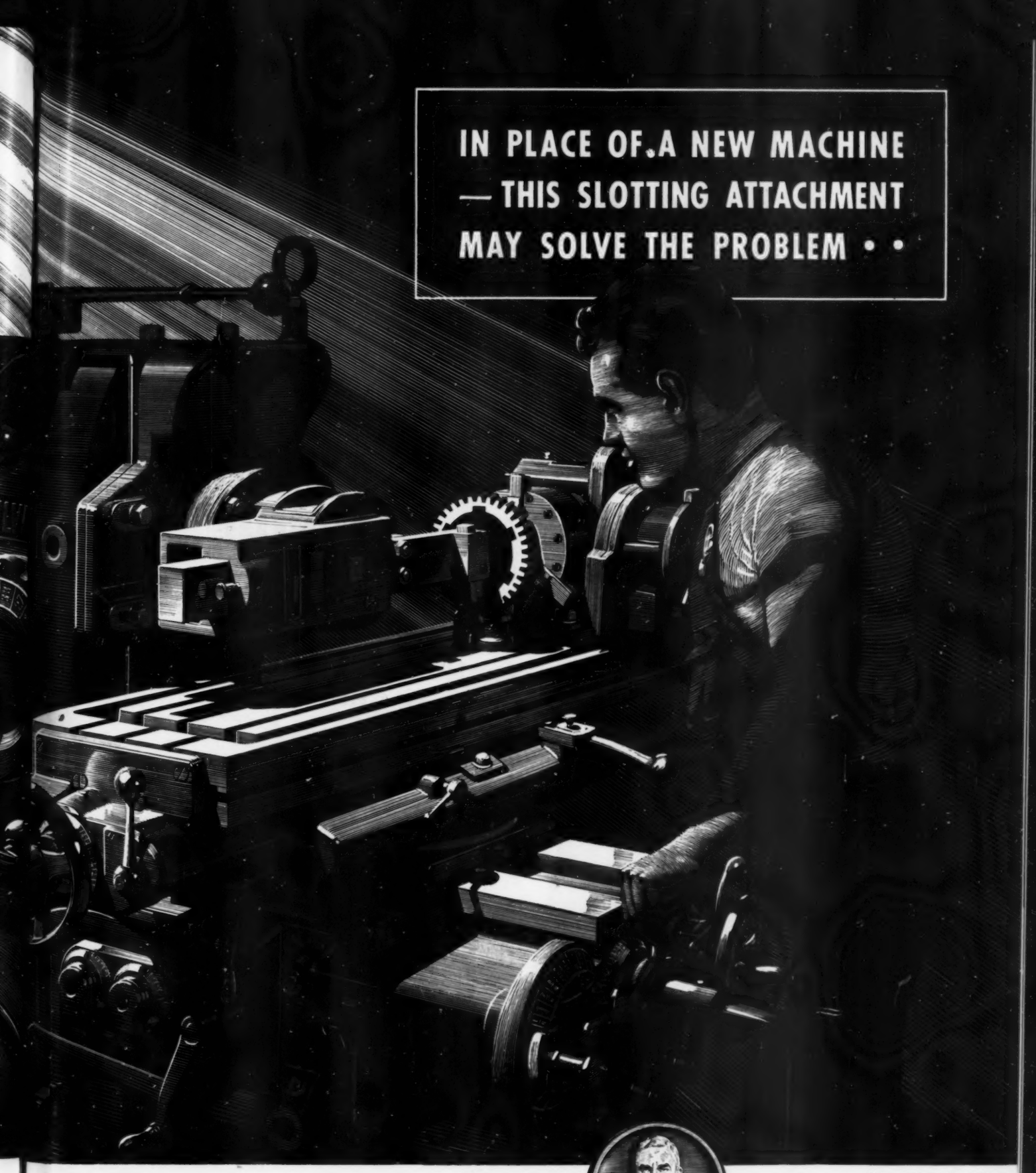
Perhaps one or more of our standard milling attachments will increase the range and versatility of your present milling machines, enabling you to get into production on a job that's been difficult to run.

Pick up your telephone and send a wire to the Emergency Production Service Department of the Kearney & Trecker Corporation, Milwaukee. State your problem clearly, including all important data. Within one hour's time after receiving your wire, arrangements will be made to have one of our field representatives contact you as rapidly as possible. Depending on the character of your problem, he will send you complete technical information or call directly at your plant.

If slotting operations are a problem in your shop because of the difficulties involved in obtaining a slotting machine, a Milwaukee Slotting Attachment will answer your needs very effectively. Models H, HL, K and KM "Milwaukees" can be quickly adapted to slotting operations by means of this sturdy, rigid attachment.

In the illustration above, the Slotting Attachment is being used in conjunction with a dividing head for milling splines on a gear. In this instance the attachment is in a horizontal plane, but it can be set in a vertical position for slotting dies and templets, or other operations.

Milwaukee MACHINE



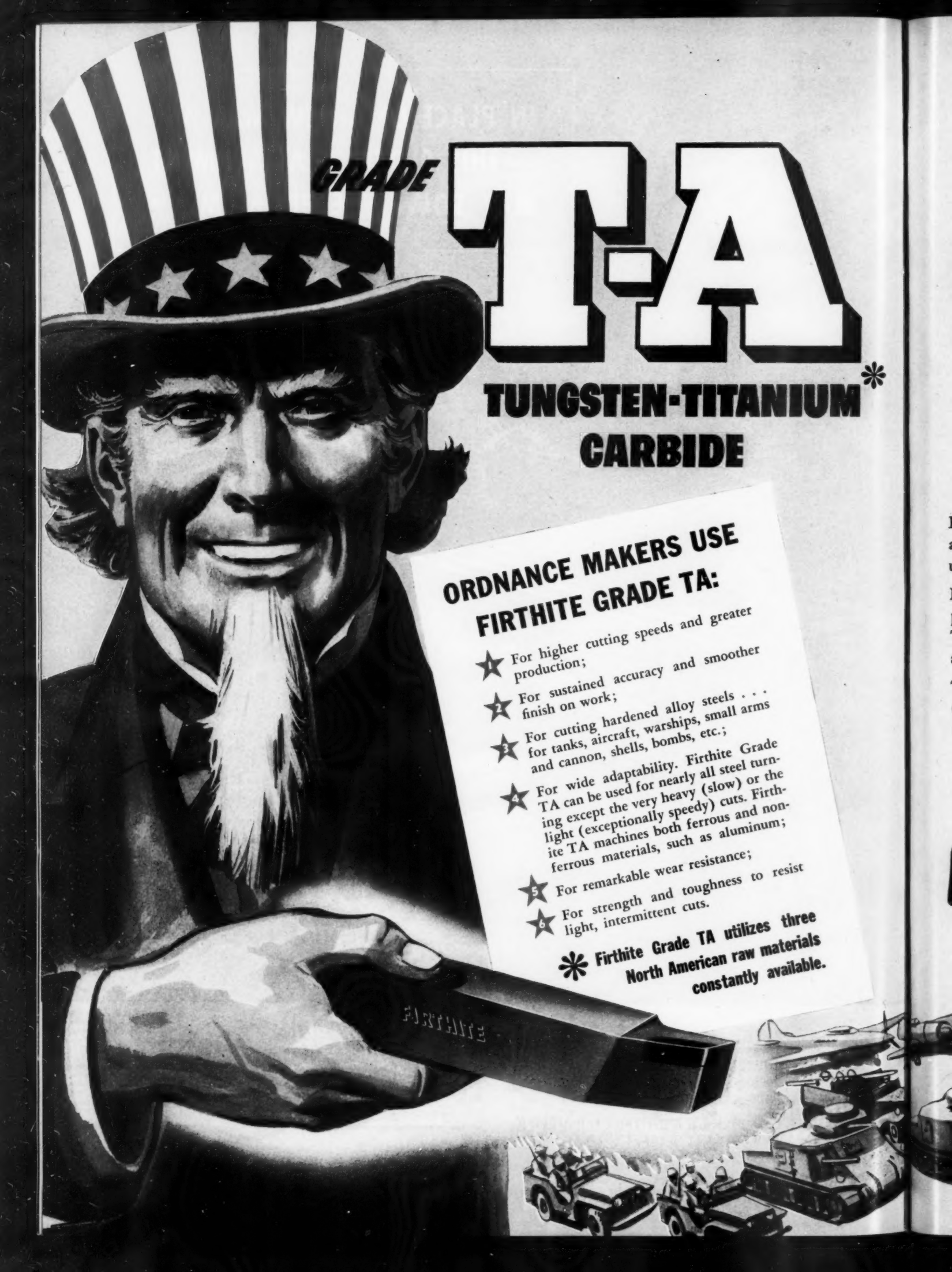
Investigate the possibilities of this and many other Milwaukee Milling Attachments for increasing production — providing greater range and flexibility to your present Milwaukee Milling Machines.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN

Kearney & Trecker offers a complete file of bulletins and technical literature including the "Right and Wrong of Milling Practice" — an illustrated handbook showing right and wrong methods of milling — full of practical advice that will aid your men to become better milling machine operators. Write Department C for your copy.

KEARNEY & TRECKER
CORPORATION

T O O L S


GRADE
T-A
TUNGSTEN-TITANIUM*
CARBIDE
ORDNANCE MAKERS USE
FIRTHITE GRADE TA:
1 For higher cutting speeds and greater production;
2 For sustained accuracy and smoother finish on work;
3 For cutting hardened alloy steels . . . for tanks, aircraft, warships, small arms and cannon, shells, bombs, etc.;
4 For wide adaptability. Firthite Grade TA can be used for nearly all steel turning except the very heavy (slow) or the light (exceptionally speedy) cuts. Firthite TA machines both ferrous and non-ferrous materials, such as aluminum;
5 For remarkable wear resistance;
6 For strength and toughness to resist light, intermittent cuts.
* Firthite Grade TA utilizes three North American raw materials constantly available.
FIRTHITE

FIRTHITE

AMERICA'S VICTORY WEAPON ON THE PRODUCTION FRONT

FIRTHITE Grade TA was developed to outperform any other cutting material used for machining steels under "average" conditions.

FIRTHITE Grade TA's sensational, dependable performance is due to the special composition: Tungsten, Cobalt, **and Titanium**—all three obtainable in ample quantities to fill wartime needs.

TITANIUM—the "wonder" ingredient in Firthite Grade TA Sintered Carbide—confers these important advantages:

TITANIUM enables the Firthite TA user to do a better, faster job of steel cutting;

TITANIUM gives the Firthite TA user a tool at a price comparable to that of high-speed steel, plus much greater productivity for the money.

TITANIUM assures the Firthite TA user of a reliable supply, since TITANIUM is one of the commonest metals — no possibility of shortage.

TUNGSTEN—essential in all sintered carbides—is available in large amounts for making all grades of FIRTHITE. (Firth-Sterling Steel Company owns the Wolf Tongue Mining Company—producers of tungsten in the United States.)

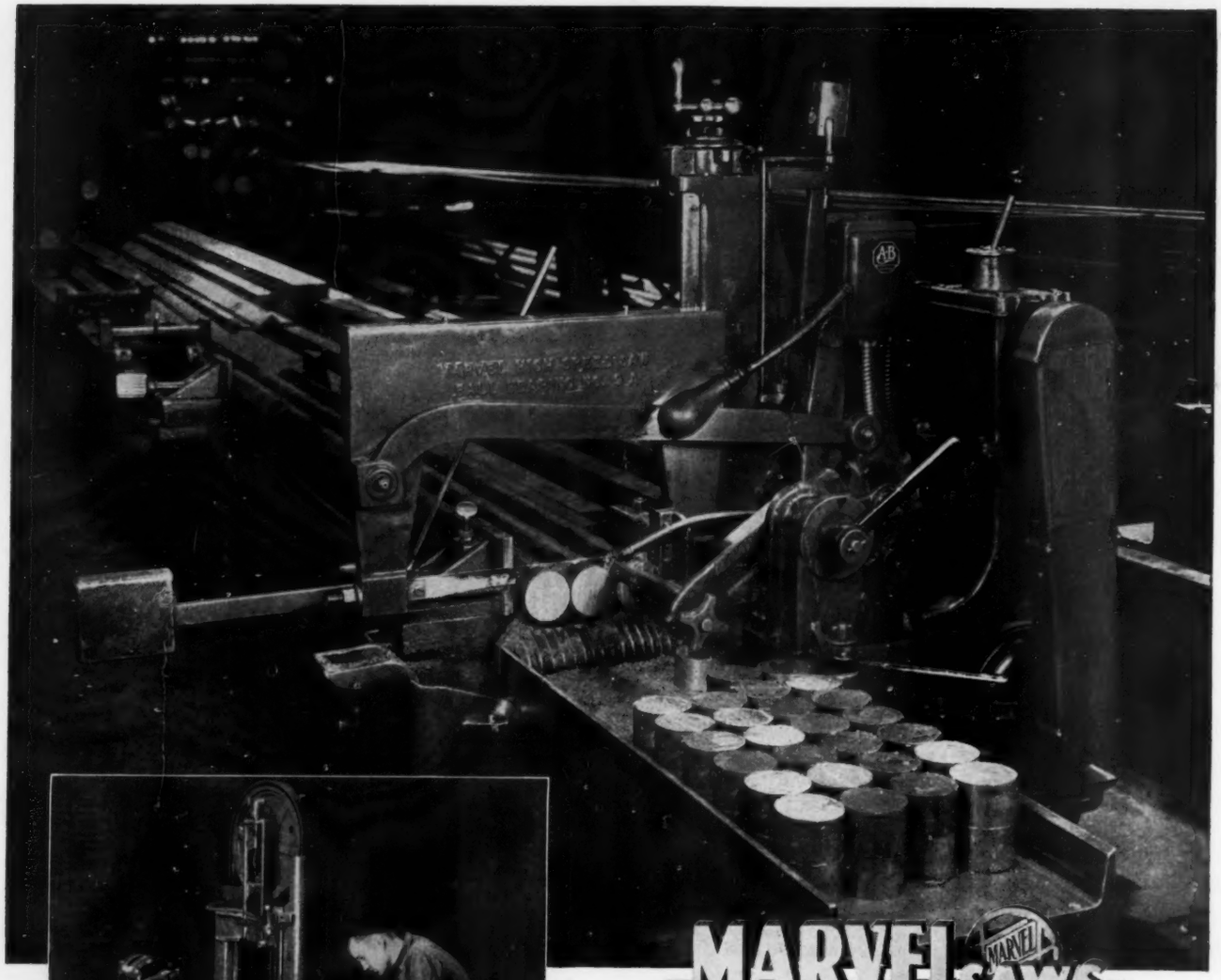
* * * * * * * * * * *

In addition to Grade TA, Firthite is made in many other grades for speedy machining of steel, cast iron, non-ferrous metals, and non-metallic compositions.

TOOL STEELS AND CARBIDES FOR COMPLETE SHOP TOOLING

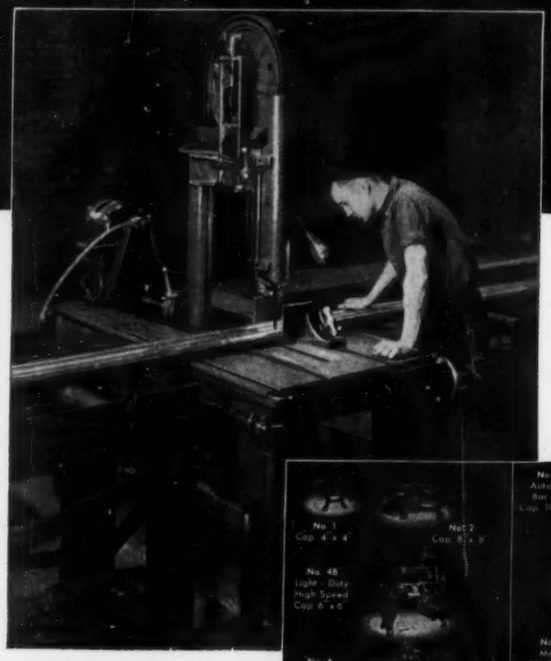
Firth-Sterling STEEL COMPANY

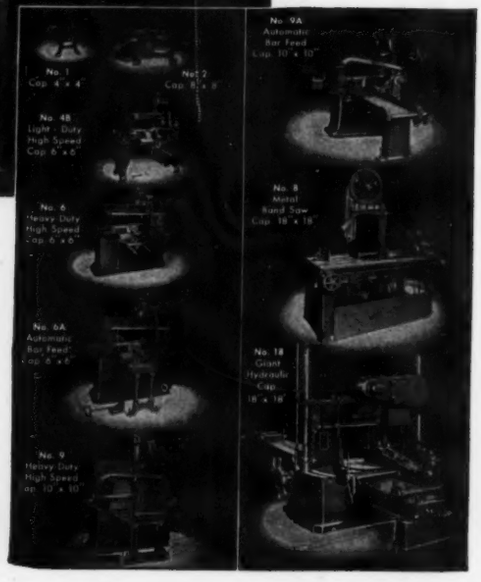
OFFICES: McKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT



MARVEL SAWS

MARVEL SAWS handle orders as they come, at Jones & Laughlin Warehouse





• **No. 9A MARVEL Production Saw automatically cutting-off quantity run — 3 bars at a time. This heavy-duty all-ball-bearing machine cannot be surpassed in speed, simplicity, ruggedness and dependability.**

• **A universal No. 8 MARVEL Metal-cutting Band Saw, that cuts-off, miters, notches or cuts at any angle from 45° right to 45° left. Blade feeds into the work.**

Hot rolled and cold finished steel squares, rounds, hexagons and flats,— single pieces or hundreds of pieces, lengths or slices, small bars or large (to 18" x 18") are cut-off quickly, accurately and efficiently at the Jones & Laughlin Steel Corp. Detroit Warehouse with MARVEL SAWS. "We are very pleased with all machines" sums up their MARVEL experience.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago, U.S.A.

Eastern Sales Office: 225 Lafayette St., New York

MID-WEST REDUCED THIS GUN MAKER'S HONING TIME BY 83 PERCENT!

How Excessive is Your Honing Time?

The X Manufacturing Company, one of the largest gun builders in the United States, ran smack into serious trouble in the honing of their three-inch and five-inch gun barrels. The honing was being done in two operations—roughing and finishing—during which approximately .011" of stock was being removed. The trouble lay in excessive heat being generated within the barrels. The heat was so terrific company engineers had to pour oil on the outside of the barrels throughout the honing operation. Notwithstanding this, the heat caused considerable distortion and many of the barrels had to be straightened and rehoned.

Furthermore, the heat limited the honing machine to a steady run of only 15 minutes, after which the barrels had to cool for two hours before inspectors could star gauge the gun. Average time required to hone a barrel ranged from 4½ to 5 hours.

A Mid-West engineer was invited in. He found the hones the company was using were too hard. They were "loading up," chipping along the edges, generating excessive heat and creating an altogether unsatisfactory finish. Following a few experimental runs with other stones he recommended the MID-WEST 180 52X hone for the rougher and the MID-WEST 500 38X hone for the finisher. These stones were adopted with this result:

- ✔ THE OIL COOLING TREATMENT HAS BEEN ABANDONED!
- ✔ INSPECTORS CAN STAR GAUGE IMMEDIATELY AFTER HONING!
- ✔ THE SURFACE FINISH HAS BEEN GREATLY IMPROVED!
- ✔ AVERAGE HONING TIME HAS BEEN REDUCED FROM 4½ TO 5 HOURS TO APPROXIMATELY 50 MINUTES PER BARREL!

That is but one instance in which MID-WEST Micro Bond honing stones have helped to save time, material and money and increase production — all vital contributions to our war effort. There are many others. Why not ask our engineers—located in most large cities throughout the United States—to tell you about them? Ask them about Micro Bond, the remarkable new abrasive developed by MID-WEST that has "given a new prod to production." Or, mail in the coupon printed herewith. Let us help YOU with YOUR honing problem.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE — DETROIT, MICHIGAN

Mid-West

- ★ *Honing Stones*
- ★ *Superfinishing Stones*
- ★ *Grinding Wheels*
- ★ *Emery Cloth*
- ★ *Sandpaper*

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

Name _____

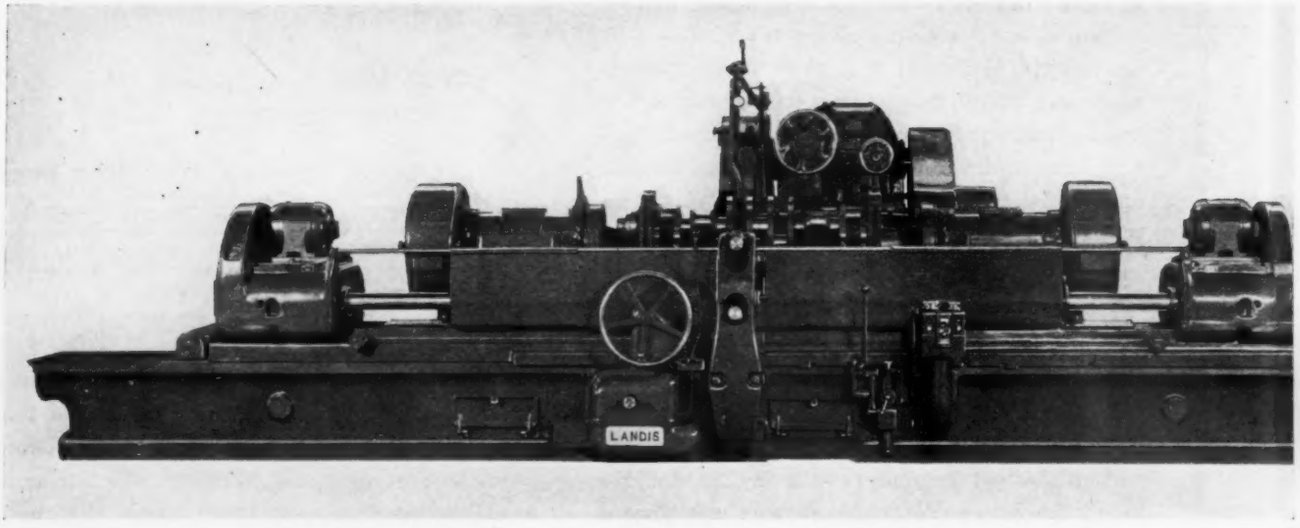
Company _____

Address _____

City _____ *State* _____

To Finish The Job Quicker . . .

CHOOSE LANDIS GRINDERS FOR THE LONG CRANKSHAFTS and CAMSHAFTS



The volume of production required these days makes it impractical to depend upon makeshift arrangements or antiquated equipment to take care of the demands.

Manufacturers of longer than average crankshafts and camshafts have found this problem acute because normally the limited demand did not justify the purchase of modern, highly specialized equipment. Now it is badly needed and Landis is supplying it.

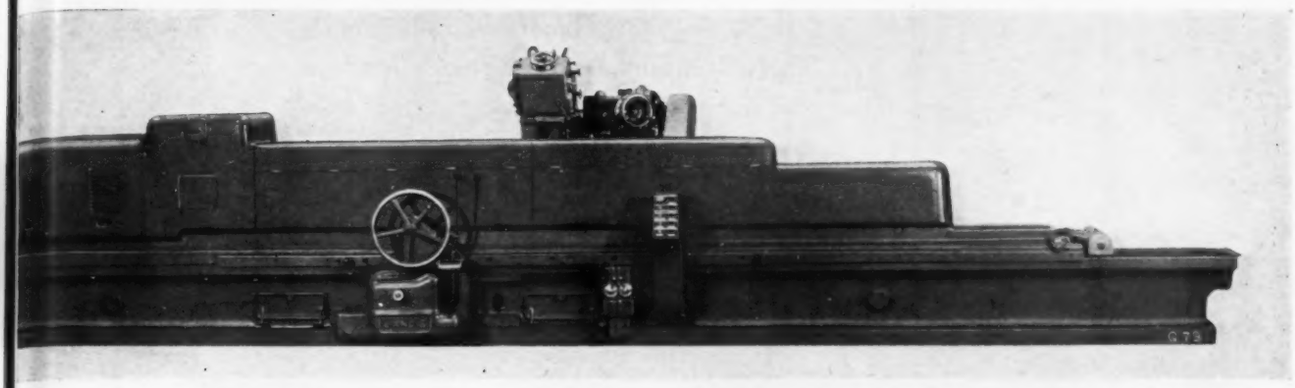
One of these machines shown immediately above is a 25" x 96" Type DD Hydraulic Crank Pin Grinder with individual motor drive to each work head. A like machine is available in 120" length for still longer shafts.

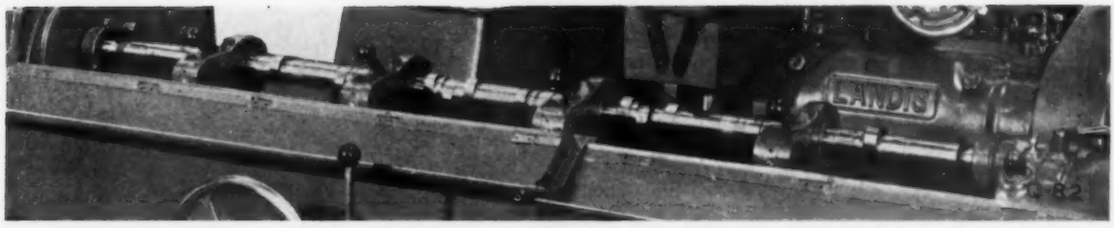
Output is high because the many principles of production crankshaft grinding employed so successfully by the automotive industry in past years have been applied to this machine. Take the stationary bed mounted work rest and the hydraulic straight infeed as examples.

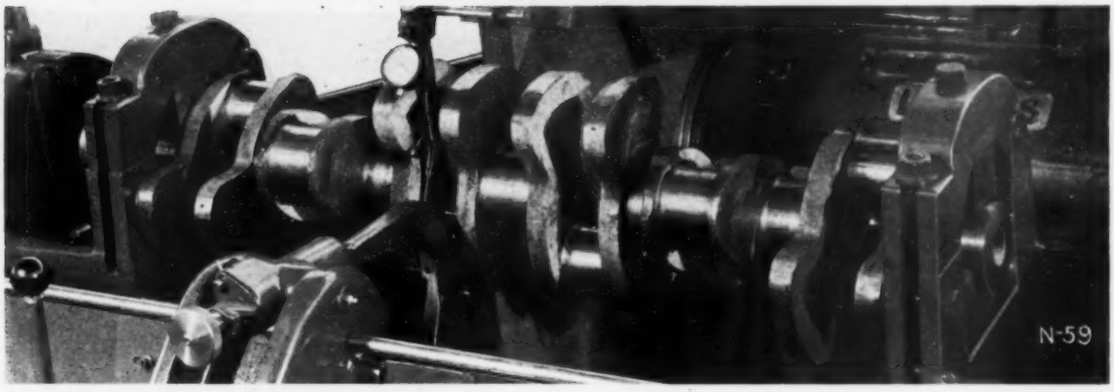
Accuracy of output is considerably improved by the work drive arrangement already referred to. Where long shafts are involved, it is essential that the drive be of such a nature that no strains are set up within the work. This is effectively accomplished on the Landis by the use of the carefully synchronized dual motor drive.

PRECISION LANDIS GRINDERS

Unusual Performance As Usual



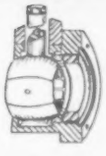




Above to the right is a 10"x120" Type D Hydraulic Cam Contour Grinder. Like the Type DD Crank Grinder, it employs many high production features which have in recent years been utilized by the automotive industry. As a consequence, the Diesel engine camshafts which it is producing are being turned out with all the speed that could be desired.

Those who are faced with the necessity of manufacturing long crankshafts and camshafts can look to Landis for engineering assistance and equipment, knowing that years of experience will back up every recommendation and every machine.

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA



MICROSPHERE WHEEL SPINDLE BEARINGS.

STATIONARY BED MOUNTED WORK REST.

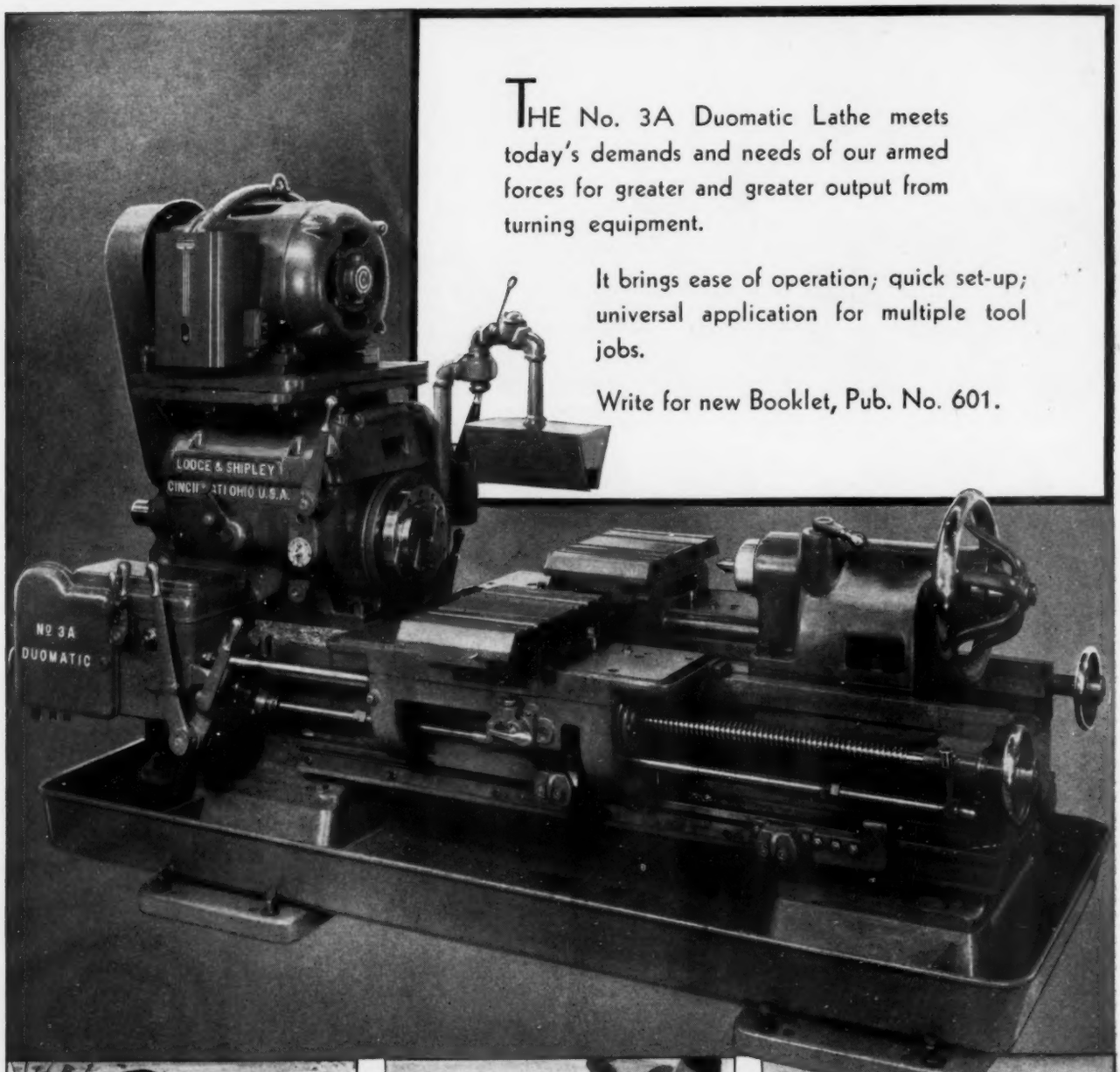
HYDRAULIC STRAIGHT INFEED.

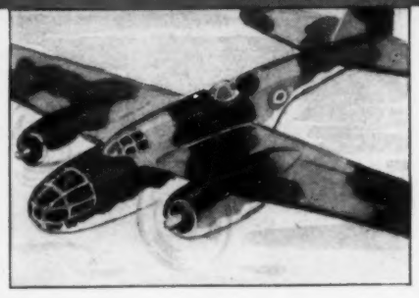
401

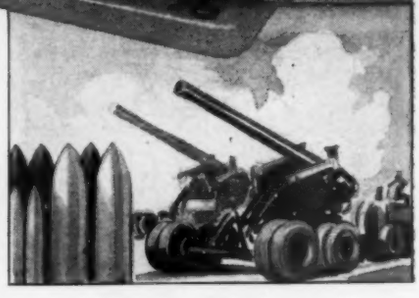
THE No. 3A Duomatic Lathe meets today's demands and needs of our armed forces for greater and greater output from turning equipment.

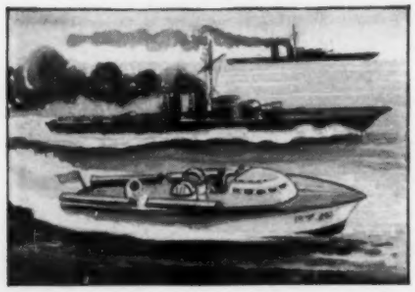
It brings ease of operation; quick set-up; universal application for multiple tool jobs.

Write for new Booklet, Pub. No. 601.







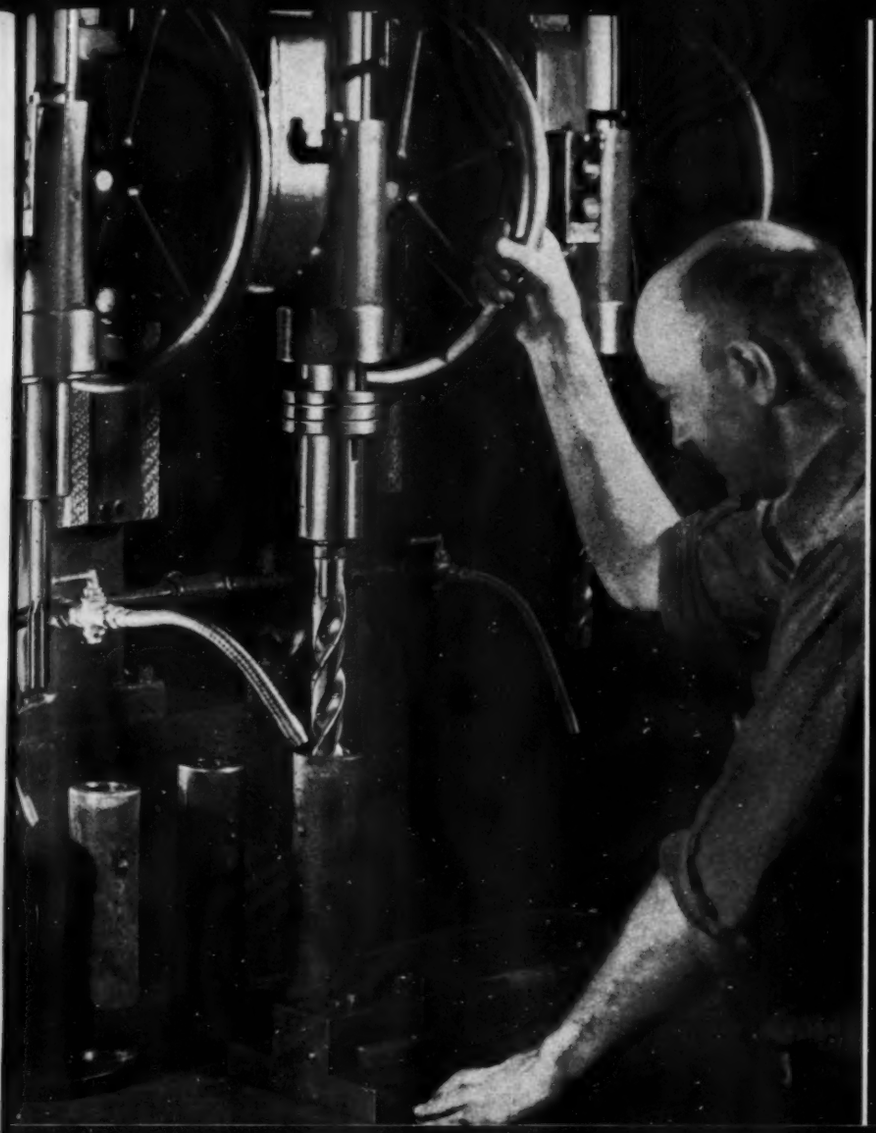


THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO

since 1892

ENGINE **TOOL ROOM** **AUTOMATIC LATHES**



DRILLED

COUNTERBORED

TAPPED

Full Range Drill
FOR MISCELLANEOUS DRILLING

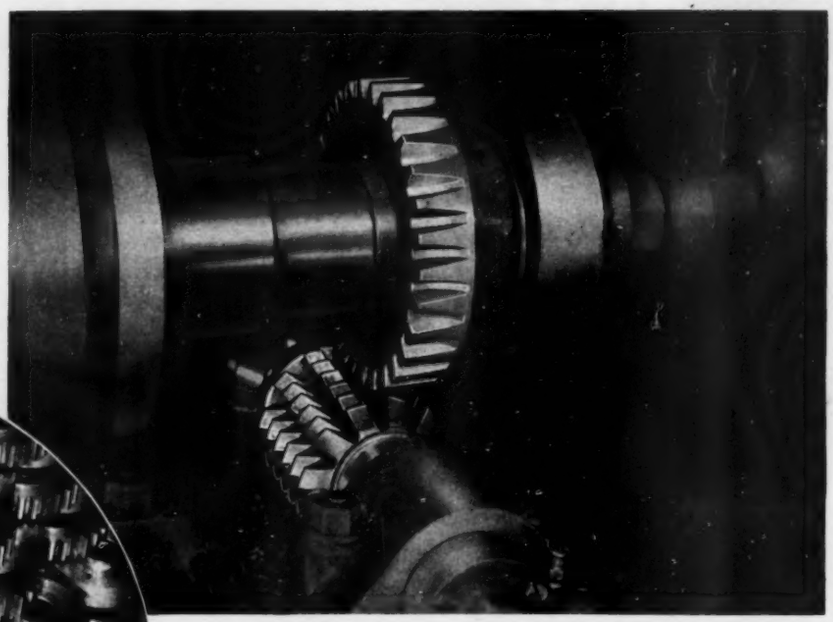
• Footburt sensitives combine the wide range of speeds needed for production drilling or tool room work with the power and rigidity to drive tools to their full cutting capacity.

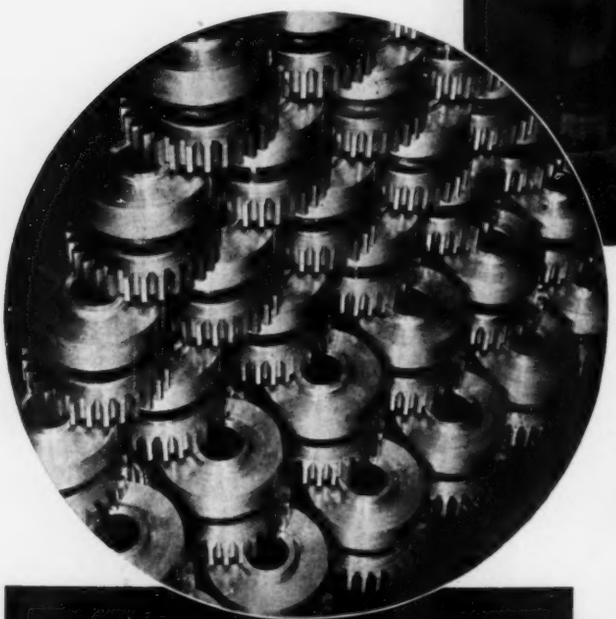
Speeds with back gear unit are available from 185 to 3500 R. P. M. on Number 2 machines, and from 118 to 820 R. P. M. on Number 3 machines. Automatic power feed and tapping attachments provide the means for highest production war work. Write or wire for price and delivery information.

THE FOOTE-BURT COMPANY
CLEVELAND, OHIO
Detroit Office: 4-253 General Motors Building

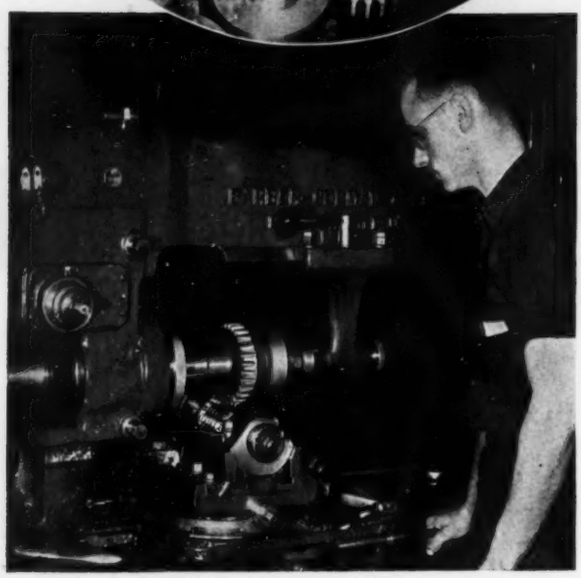
FOOTBURT *Sensitive* DRILLING MACHINES

The gears shown below are low-speed reverse idlers for a heavy truck transmission, as made in the shop of a large company specializing in gear manufacturing. The pile shown is half finished, with the teeth on the smaller gear still to be cut.





CLIMB HOBBING TRANSMISSION GEARS WITH TAPER HOLE HOBS ON A BARBER-COLMAN TYPE "A" HOBBING MACHINE



CLIMB hobbing has a number of advantages, among which are longer hob life and smoother finish on the hobbed gears. Taper hole hobs have the main advantage of giving consistently greater accuracy on gear tooth profiles because run-out of the hob on its spindle is held to .0001" or .0002". The Heavy-Duty Hob Slide permits the use of larger hobs, with more teeth, for longer hob life or greater cutting capacity. All of these advantages were combined on the job shown here, to produce economically, in one cut, gears with good finish and a high degree of accuracy. Perhaps you, too, can take advantage of some of these valuable benefits. We suggest a consultation with your Barber-Colman representative for specific suggestions.

HOB DATA

Hob Used—B-C 3¾" x 4" taper hole, ground single-thread.
Pieces per Sharpening—150.
Cutting Method—Climb.

MACHINE SET-UP

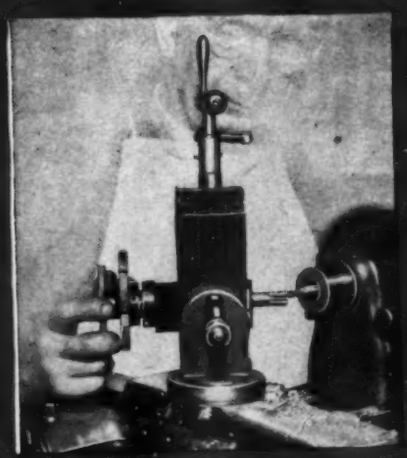
Material—SAE 4620.
Larger gear—29 teeth, 5-6 pitch, involute form, 6.115" O.D., 1-1/8" face.
Smaller gear—25 teeth, 5.405" O.D., 1-11/32" face.
Hob Speed—139 r.p.m.
Feed—.060" per rev. of work.
Production—50 pieces in 8 hours, each gear.
Work held on arbor chucked in collet.
Machine—Barber-Colman Type "A" Hobbing Machine with Heavy Duty Hob Slide and Tapered Hob Spindle.

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

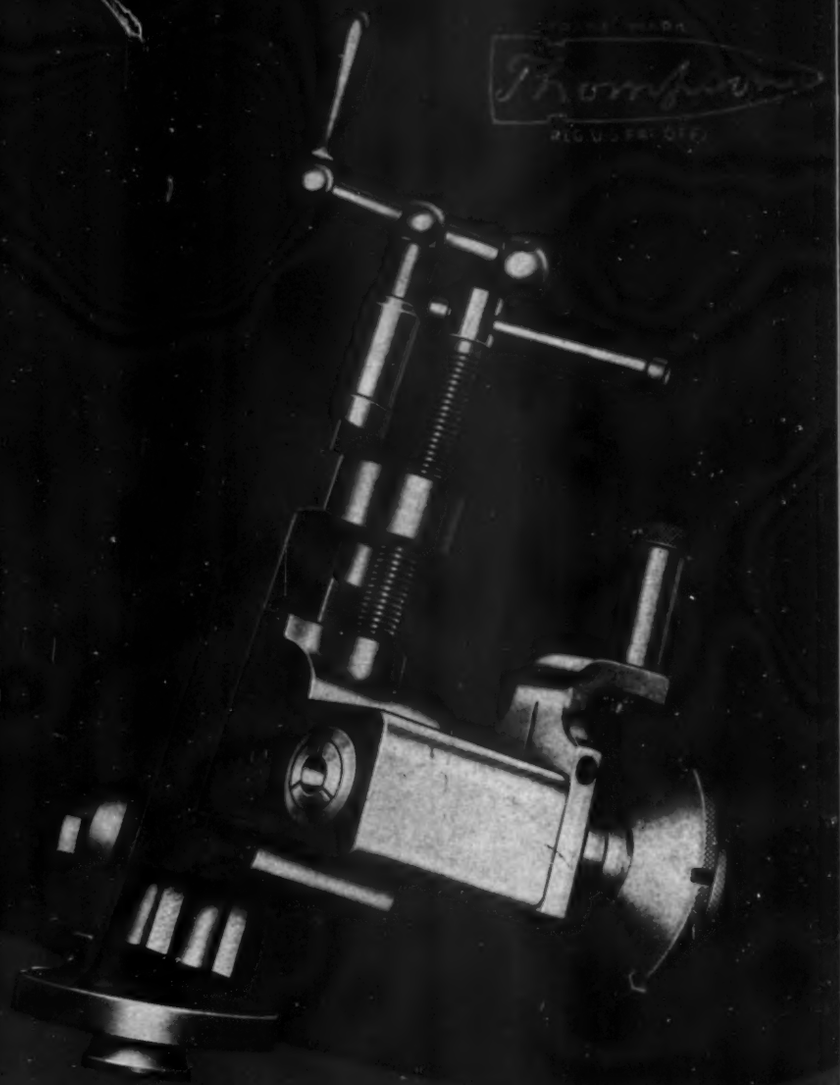
BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

The Thompson Universal milling Fixture at right angles, as some times used for milling straight teeth in cutter.



The base of the Thompson Fixture is set at 30° angle in this picture where end teeth in cutter are being milled.



Thompson

UNIVERSAL MILLING FIXTURE

for efficient toolroom or production use

Any standard bench lathe can be converted into a fast, versatile, accurate milling machine, capable of performing a wide variety of work, by attaching the THOMPSON UNIVERSAL MILLING FIXTURE.

The 3-way circular swing which is an important feature of the "THOMPSON" adapts this modern, sturdy fixture to straight or angular milling as well as for milling punches, end mills, key ways, counter bores or the manufacture of duplicate parts. Adaptable to both tool room and production requirements, the THOMPSON UNIVERSAL MILLING FIXTURE is a practical time-saving device which has proved its efficiency and economy on a wide variety of work. Explore its possibilities in your work immediately by sending for further details.

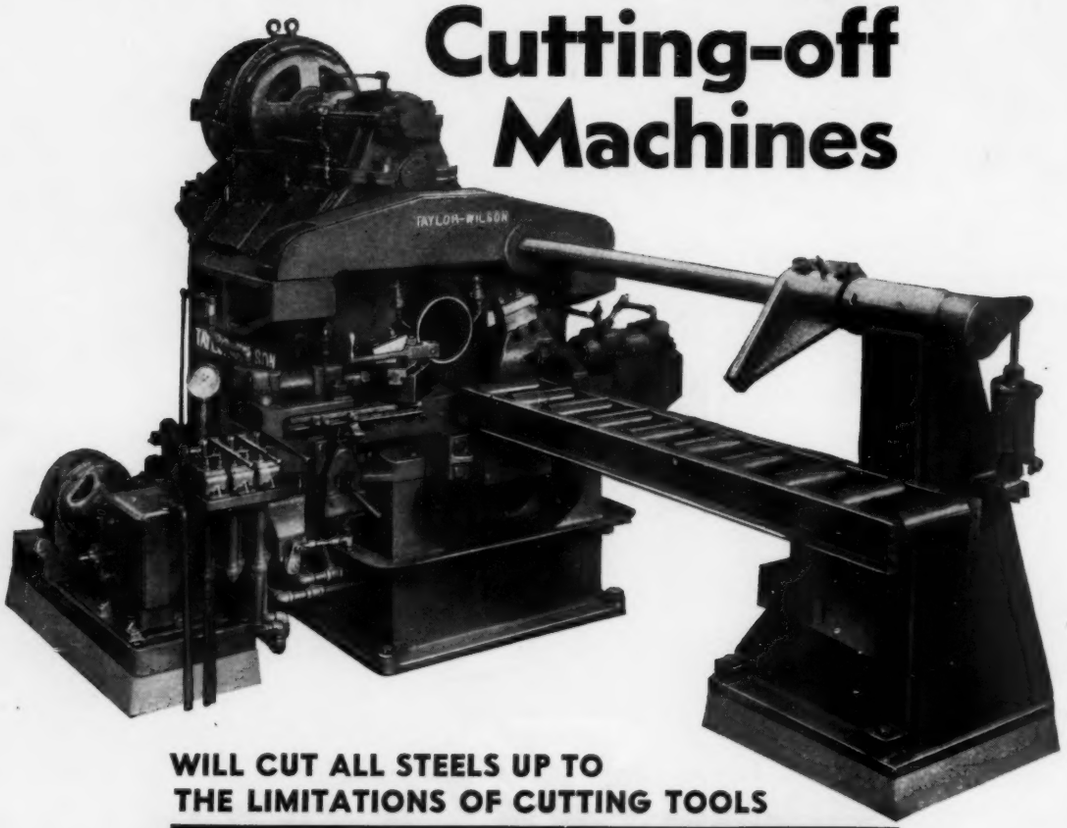
AUTO-ORDNANCE CORPORATION

1437 RAILROAD AVE. • BRIDGEPORT, CONNECTICUT

Also Manufacturers of the Willard Spring Tool Holders

TAYLOR-WILSON

Cutting-off Machines



WILL CUT ALL STEELS UP TO THE LIMITATIONS OF CUTTING TOOLS

Taylor-Wilson Cutting-Off Machines are aiding the war effort by enabling essential industries throughout the country to step up production beyond normal plant capacity.

They operate smoothly and without vibration even at greatly accelerated speed. And in cutting tubing made of any grade of steel, are restriced only by the limitations of the cutting tools. Simple, one-man control brings added economy.

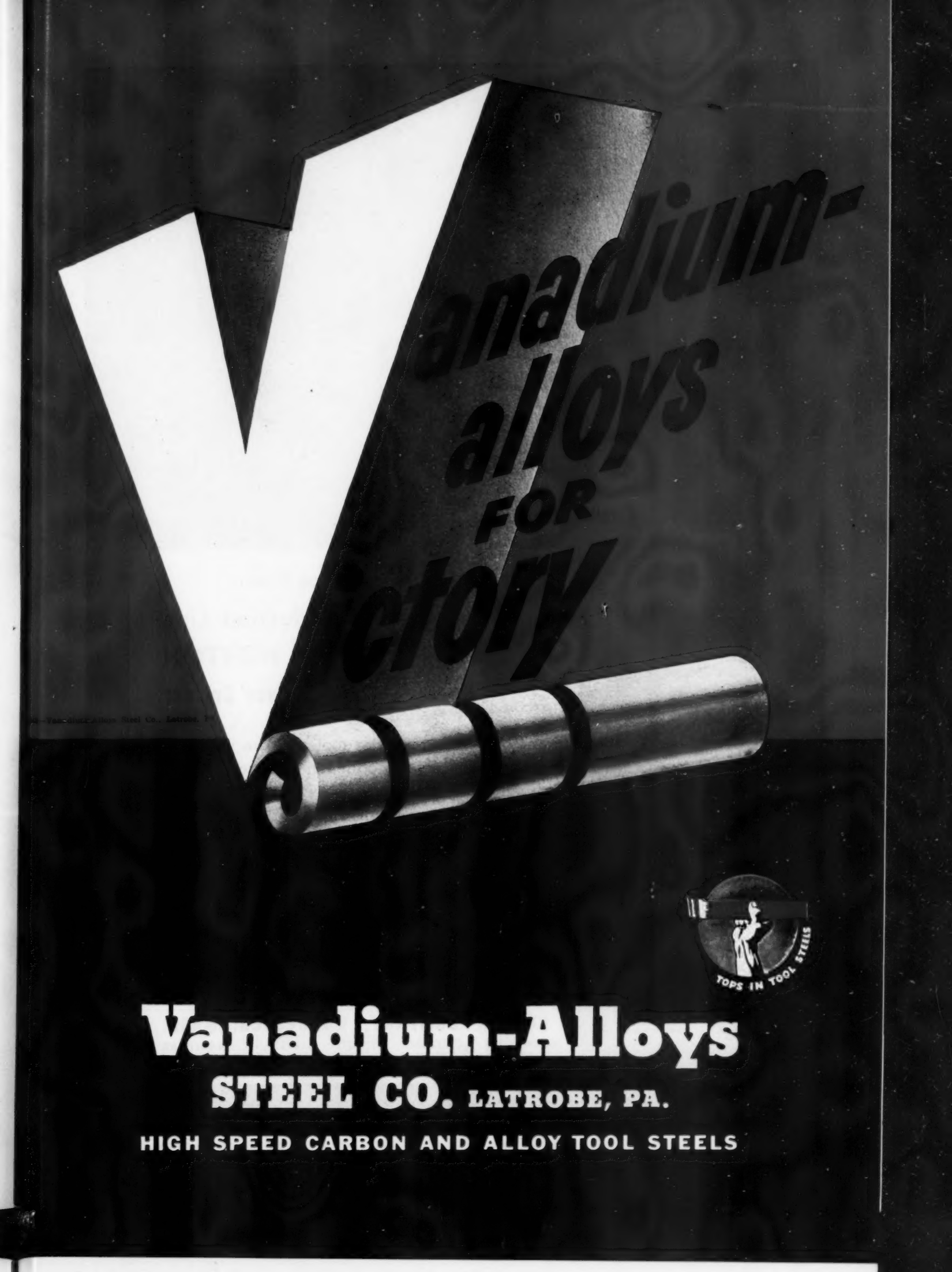
Especially designed for cutting Bomb Blanks, Roller Bearing Blanks, Coupling Stock and other essential items.

Write for descriptive literature.

TAYLOR-WILSON MFG. CO.

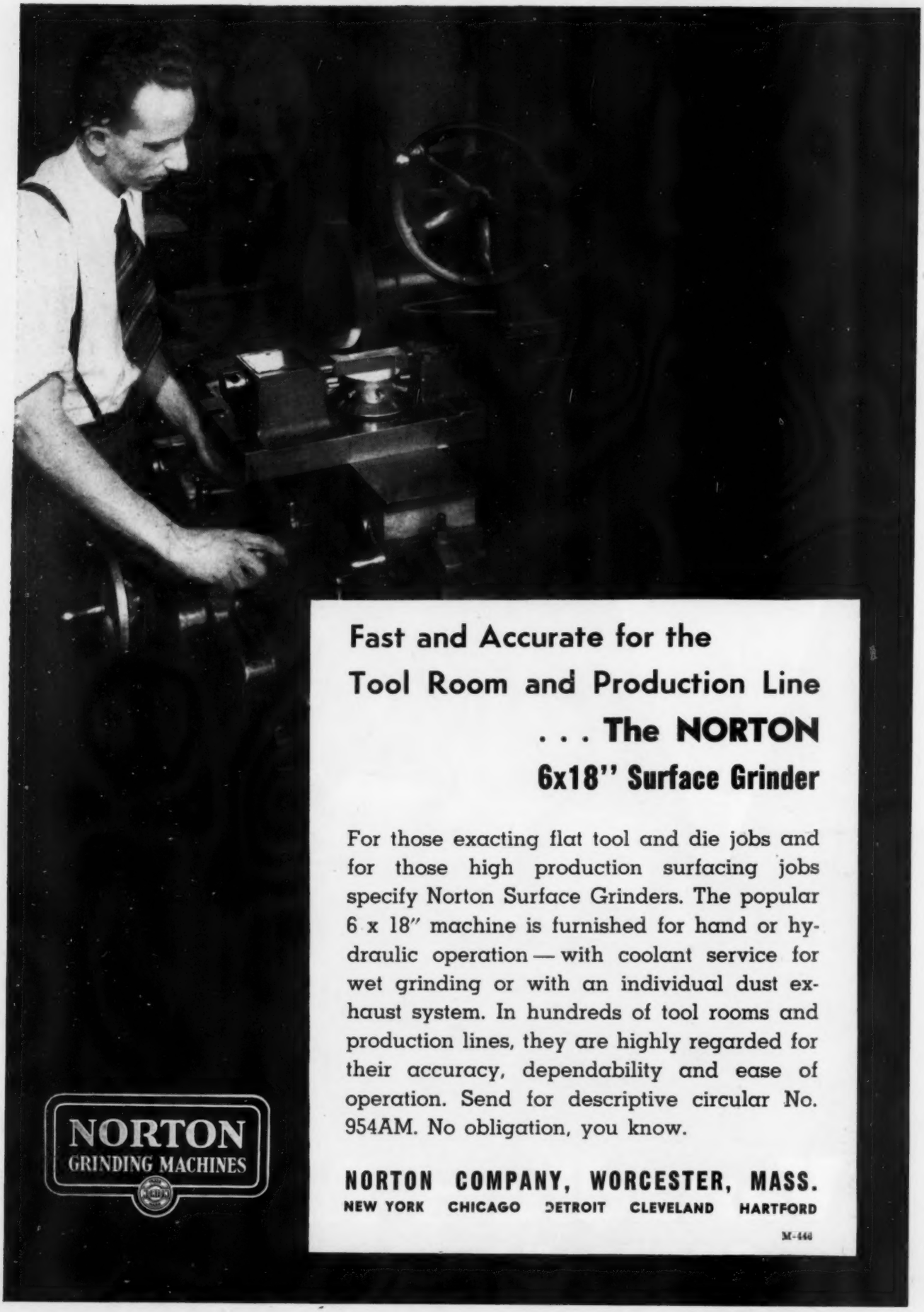
35 Thomson Ave., McKees Rocks, Pa.

PITTSBURGH DISTRICT



Vanadium-Alloys
STEEL CO. LATROBE, PA.

HIGH SPEED CARBON AND ALLOY TOOL STEELS



Fast and Accurate for the Tool Room and Production Line . . . The NORTON 6x18" Surface Grinder

For those exacting flat tool and die jobs and for those high production surfacing jobs specify Norton Surface Grinders. The popular 6 x 18" machine is furnished for hand or hydraulic operation — with coolant service for wet grinding or with an individual dust exhaust system. In hundreds of tool rooms and production lines, they are highly regarded for their accuracy, dependability and ease of operation. Send for descriptive circular No. 954AM. No obligation, you know.

NORTON GRINDING MACHINES

NORTON COMPANY, WORCESTER, MASS.

NEW YORK CHICAGO DETROIT CLEVELAND HARTFORD

M-446

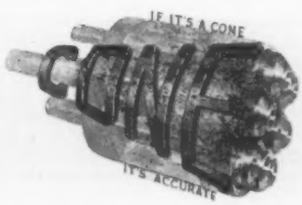
A BRAIN THAT'S ALWAYS *Clear*

CLEAR OF DIRT
CLEAR OF CHIPS
CLEAR OF COOLANT

Multiple spindle Conomatics have a brain that's always clear. This brain is the camshaft which is located overhead in the top bed. This exclusive Cone feature is a time saver. It is free from dirt, chips, and coolant, yet easily accessible. These features result in minimum wear and maintenance — simplify quick job changeovers.

A clear brain is essential to fast, dependable action. A time study of your own parts will show you just how fast Conomatics can be. They are built with 4, 6, and 8 spindles.

Write, wire, or phone for further information.



CONE

AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT
U. S. A.

PHOTO BY U. S. ARMY SIGNAL CORPS

The Yanks are Coming!

Scout cars and motorcycles, trucks and tanks furnish the fast, flexible ground transportation necessary to modern warfare.

Under the grinding, wearing shock of roadless terrain American built machines are proving they have the stamina that delivers the men and materials.

The contribution which American mechanics and engineers are making to the Allied cause will be the determining factor in final Victory. The Fenn plant is now engaged in an "all out" job, but sometime in the future it will again be a good place to come for special machinery and parts.

FENN

THE FENN MANUFACTURING CO.

HARTFORD, CONNECTICUT • ESTABLISHED 1900

THERE'S MORE THAN ONE SHOT IN THE TOOL STEEL MAGAZINE

FOR every machining job, there is a tool steel which will produce optimum results as regards the amount of work done per machine hour and per grind.

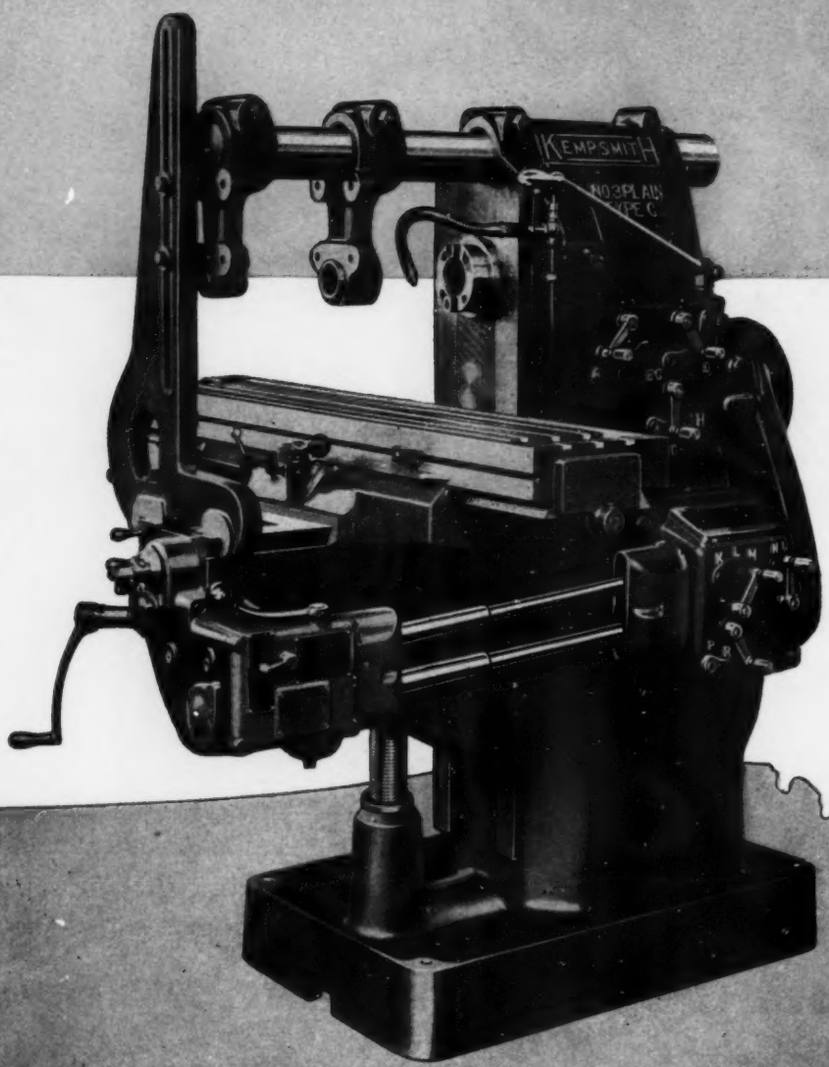
Teaming up the right tool steel with the job frequently shows phenomenal improvement. For instance, with a connecting rod broach made of DBL High Speed Steel, a well-known engine builder secured 13,533 pieces for the life of the broach, against a previous best average of 8000 pieces. The increase is almost 70%. A similar company, using 3/8" twist drills made of DBL, secured an average of 30% more holes per grind than with 18-4-1.

War production calls for the best possible performance from every machine tool, new or old. Let our engineers help you to determine the right tool steels to use on your jobs, for improved results. At the same time, they'll make you familiar with the best *alternate* steel, for your protection in the event of possible future shortnesses in supply.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

KEMPSMITH *and* INDUSTRY

MUTUALLY MILLING *for* VICTORY



For Toolroom and general production work the new KEMPSMITH TYPE "G" All-Geared MILLER (plain or universal) has centralized control, 18 speeds and feeds (ball bearing speed, feed and spindle assemblies), Knee Gib, Unit Construction, Motor-in-Base . . . and other features that make it precise and reliable, economical in first cost, fast and efficient for PRODUCTION NOW!

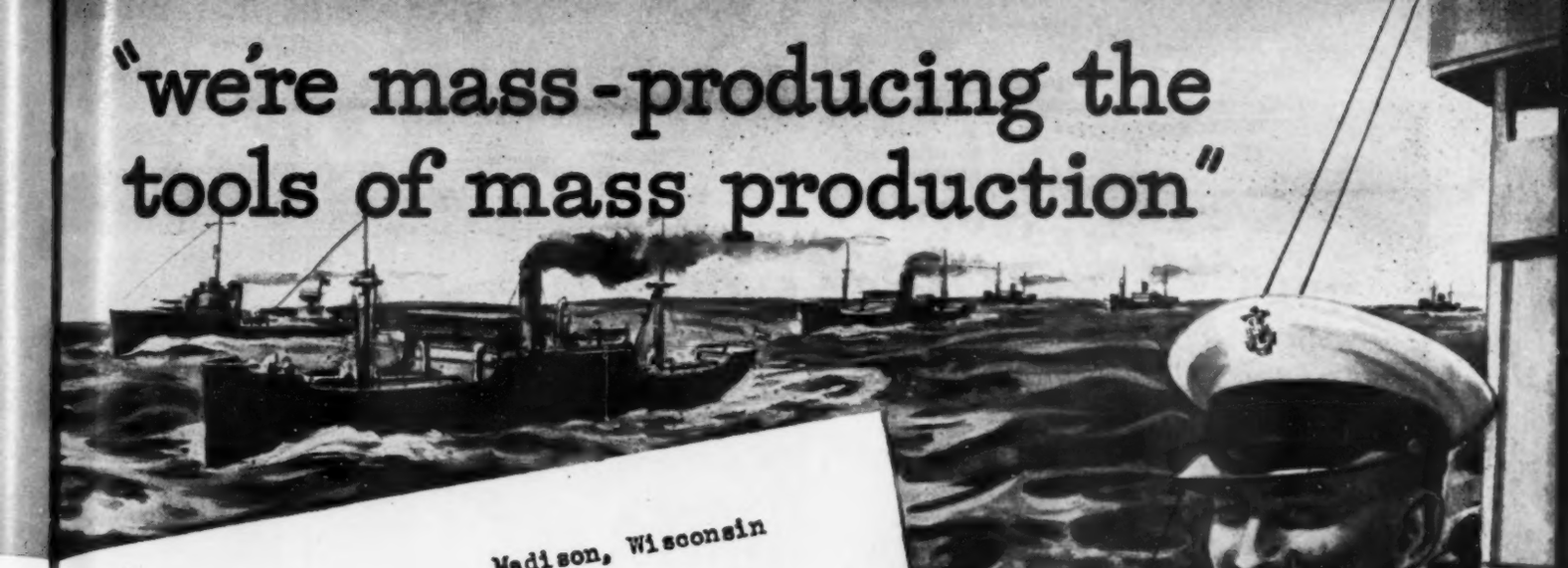
YOU AS USERS
and WE as PRODUCERS

are teach in common today . . . 24-hour days, 168-hour weeks, speeding for speed . . . really making [illegible] vital to victory!

Every [illegible] that goes into this all-out PRODUCTION NOW industrial [illegible] has the advantage of 36 years of milling machinery experience . . . built to take today's [illegible] schedules in stride . . . milling machines that won't "let you down."

PRECISION
MILLING MACHINERY
Experience SINCE 1888
KEMPSMITH MACHINE CO.
MILWAUKEE • WISCONSIN

"we're mass-producing the tools of mass production"



Madison, Wisconsin

Dear "Admiral":

Perhaps out there at sea you often wonder what we're doing back home. Wish you could see for yourself. You'd hardly know the old place.

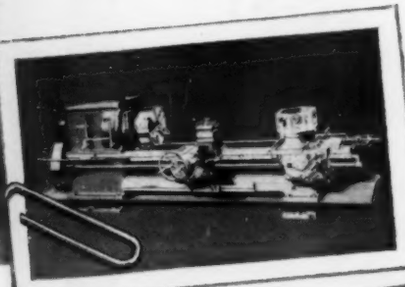
It would do your heart good to see our production line for the new "Victory" lathes. Here's a good example of the way American engineers can meet an emergency like this! Actually, you could say that we're mass-producing the tools of mass production! We're building these big turret lathes 15 times faster than our former peak capacity in these sizes!

How'd we manage to do it? Maybe the censors wouldn't like to have us put the whole story in writing. But take our word for it, there'll be no "aid and comfort" for the enemy in the number of them that are going to work in vital war plants!

One thing you can count on: this country is going to out-produce the Axis by a wide margin. We're "all out" to end this war as soon as possible. And when it's over, we hope you can be as proud of the home folks as they are of you.

Salutes!

The fellows at Gisholt



These new Victory lathes are big Saddle Type machines: Two sizes: 21" and 24" chucks; 5¼" and 9¼" spindle bores.

GISHOLT

THIS letter may be good news to any man in the fighting forces. But it's even more to the point for the man trying to increase production capacity in vital war plants.

GET YOUR ANSWER AT

America's War Conference on Metals!

War has developed new products, new production equipment and new ideas. All of these aids to greater production will be shared when the metal industry meets for the 24th year at the National Metal Congress and a War Production Edition of the National Metal Exposition, the week of October 12, in Cleveland.

Here is your opportunity to discuss your problems with other leaders in the industry. It is your opportunity to see what war metals are adaptable to your production, to study the best in equipment and supplies, to learn how other plants are meeting their war problems.

This is your opportunity—and your responsibility—to help your industry carry forward its giant task of winning this war of metals. You may listen to as many as 100 technical papers presented by the four great cooperating societies. You may attend the numerous war production conferences. You may consult with manufacturers' experts in more than 230 educational displays. Plan to attend this great war conference on metals.

● *Display Space Still Available—more than 230 manufacturers have reserved 89% of the display space available in this 100% educational meeting. If you serve the metal industry, reserve your space now and put your technical experience and information on the war production line, where it will do the most good today.*

TIME

OCTOBER 12 TO 16,
MONDAY THRU FRIDAY

PLACE

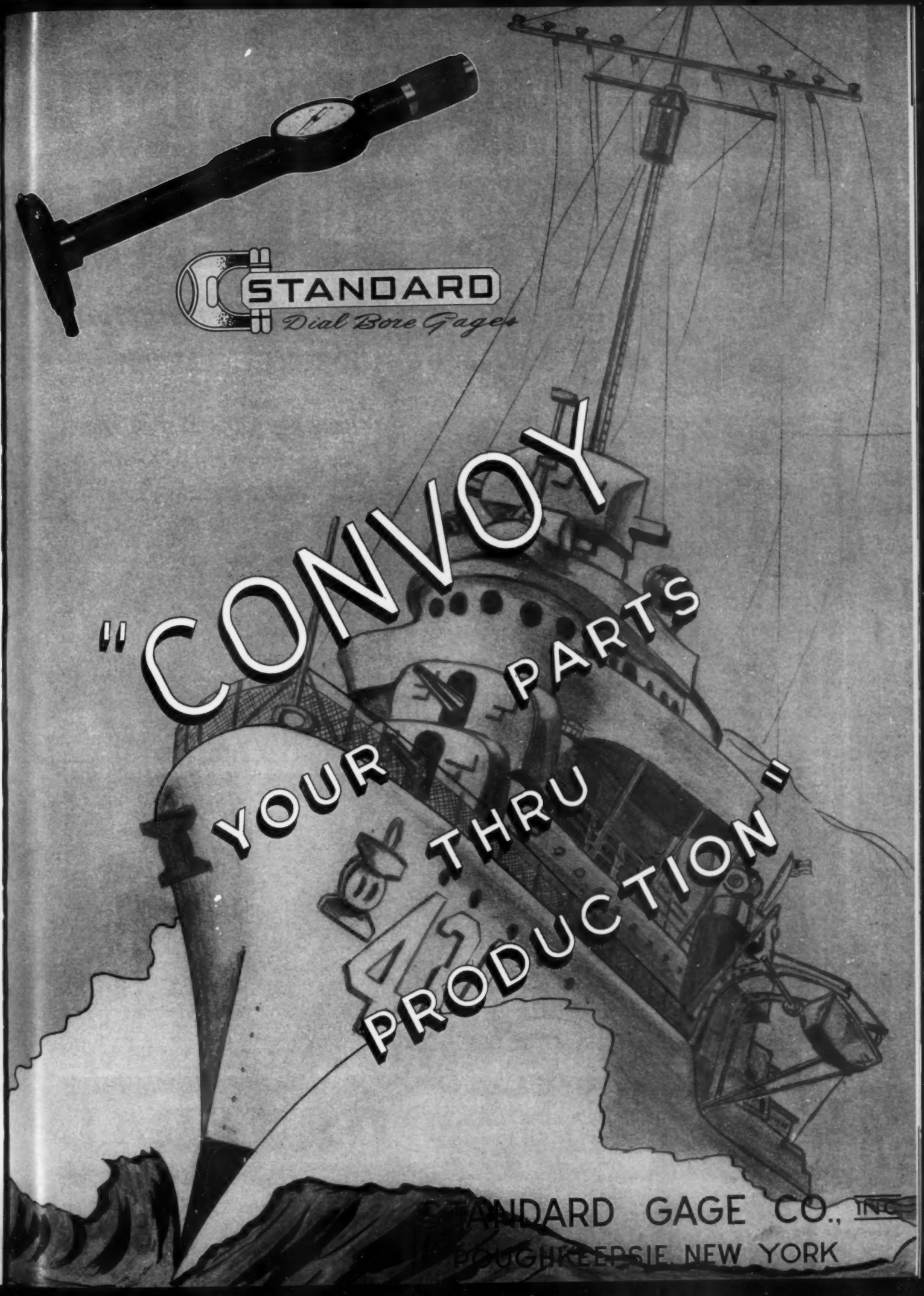
CLEVELAND'S
PUBLIC AUDITORIUM

EVENT

THE NATIONAL METAL
CONGRESS AND
WAR PRODUCTION EDITION
NATIONAL METAL
EXPOSITION

THEME

INCREASED PRODUCTION
OF WAR PRODUCTS


STANDARD
Dial Bore Gages
"CONVOY
YOUR PARTS
THRU
PRODUCTION"
STANDARD GAGE CO., INC.
POUGHKEEPSIE, NEW YORK

WARTIME LIGHTING COSTS REDUCED!

General Electric announces a 12% to 17% reduction in the price of G-E MAZDA FLUORESCENT LAMPS!

Effective September 1, 1942

NEW LOW PRICES ON G-E MAZDA F LAMPS

14-WATT T-12	was 80c	now 70c
15-WATT T-8	was 65c	now 57c
15-WATT T-12	was 80c	now 70c
20-WATT T-12	was 80c	now 70c
30 WATT T-8	was 80c	now 70c
40-WATT T-12	was $1.15	now 95c
100-WATT T-17	was $2.60	now $2.15

Above prices refer to daylight and 3500° white. Prices also reduced on soft white and colored G-E MAZDA F lamps.

Also reduced! G-E MAZDA H (Mercury) LAMPS

400-WATT T-16 AH1	was $11.00	now $9.50
400-WATT T-16 BH1	was $11.00	now $9.50
3000-WATT T-9½ AH9	was $45.00	now $40.00

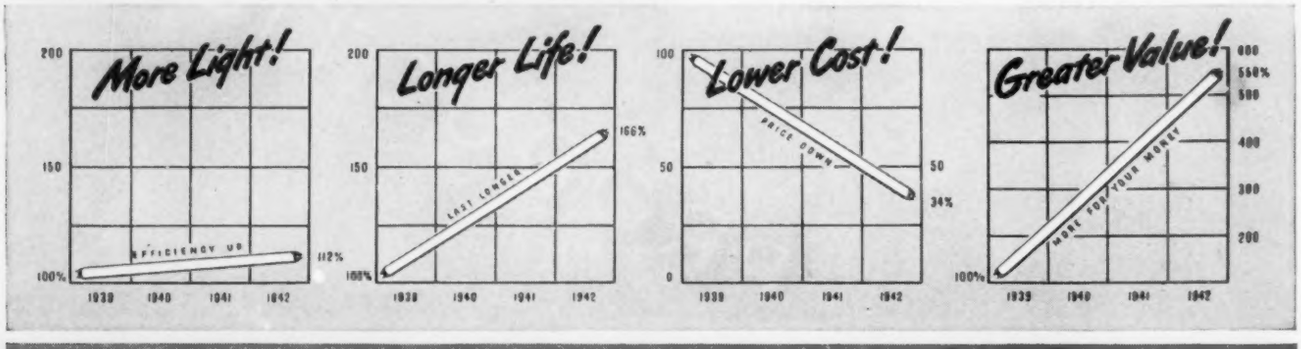
THE SEVENTH REDUCTION IN FOUR YEARS!

NO price reduction, of the many we have been able to make, gave us in General Electric as much genuine satisfaction as this one—made possible at a time when light is being called upon to play a major role in wartime production.

Made in the face of rising cost trends, this reduction is the result of manufacturing economies and technical developments, combined with vastly increased use. It is made in accordance with G-E's policy of passing such savings along to customers.

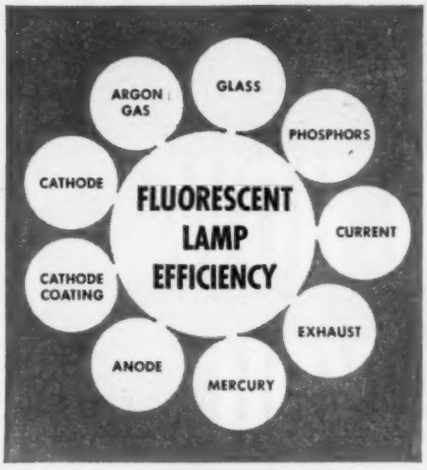
But lower prices are only half the story. Not only have we been able to reduce prices, we have steadily improved these lamps. They give more light! They last longer! They *stay brighter longer!*

For instance, purchasers of the widely used 40-watt white G-E MAZDA F lamp now pay only 95c instead of the $2.80 they paid in 1939. But we are prouder that this lamp lasts 66% longer and is nearly 12% brighter . . . that it gives you 5½ times more value for your lamp dollar than it did in 1939! (See charts below.)



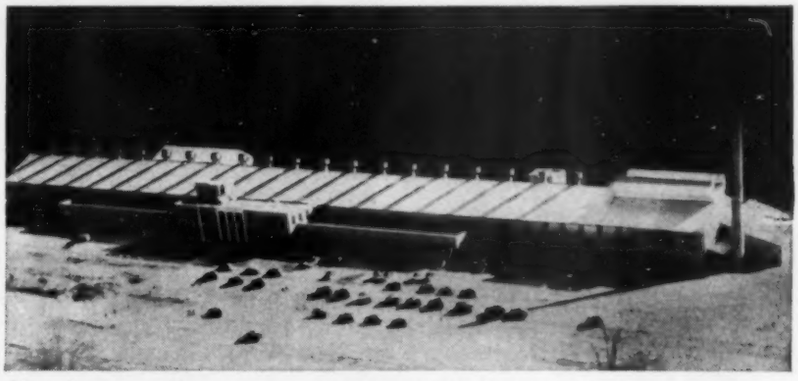
The Story Behind MORE LIGHT *for* LESS COST

G-E research constantly seeks the best possible combination of all factors affecting lamp efficiency. Here are nine of the most important. There are more than a million possible combinations of these factors. It's the task of G-E research to find the *best* possible combination!

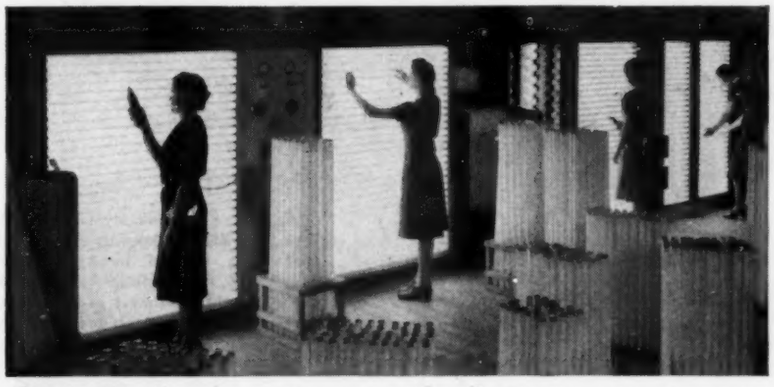


All materials are tested with extreme care. Here, we check the brightness of phosphor powders that coat the inside of fluorescent lamps to make sure that you get maximum performance from your G-E MAZDA F lamps.

Experience counts. W. L. Enfield (left) and P. J. Pritchard have been active in directing research for better product and lower prices.



Here is one of the new streamlined, specially designed G-E fluorescent lamp factories that have helped materially in reducing costs. Sand for glass tubes comes in at one end. Finished lamps are shipped from the other.



Constant testing guards the quality of G-E MAZDA fluorescent lamps. At every stage in the manufacturing process, General Electric inspections provide safeguards of quality. Above, G-E MAZDA lamps are inspected while undergoing a "seasoning" process on the test racks.

Extra assurance of quality is a series of over 50 tests and checks on completed lamps by MAZDA SERVICE inspectors, who work under the direction of an independent testing laboratory.

GE ELECTRIC MAZDA

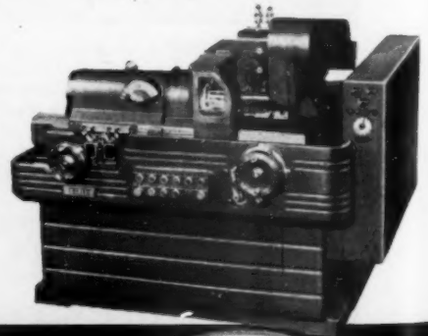
...AND HOW WILL YOU MAKE THEM

If accurately threaded work is your problem, keep in mind the many advantages of Ex-Cell-O's modern thread grinding machine—*extreme precision with speed and economy in production of hardened threaded parts . . . and the use of semi-skilled operators.* The higher standards of accuracy that war work establishes today will be equally demanded when civilian needs are again in the forefront . . . an Ex-Cell-O thread grinder, on which an exceptionally wide range of work is possible, places you in a favored position to produce accurately threaded hardened parts . . . *today* . . . and *tomorrow.*

EX-CELL-O CORPORATION • DETROIT, MICHIGAN

War Bond "Bull's-Eye" Flag . . . first to be awarded in United States . . . presented by U. S. Treasury to Ex-Cell-O, where men, machines, and money are all working for Victory!

Below: One of nine styles of Ex-Cell-O Precision Thread Grinders (Style 39-A for producing internal threads). Ex-Cell-O engineers, who brought thread grinding as a successful process to U. S. industry, are familiar with all threaded work needs.

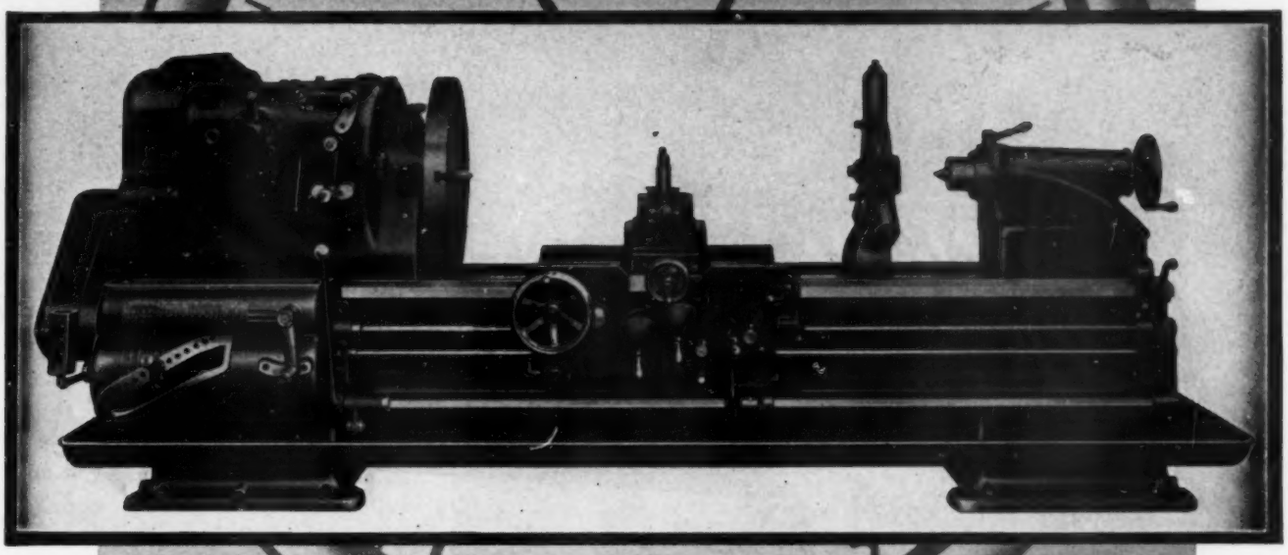


Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

XLO

EX-CELL-O *means* PRECISION

Work twice around the clock WITH SPRINGFIELD GEARED HEAD LATHES



● The current war production program calls on every manufacturer to do his utmost in meeting present day requirements, even if it means working 24 hours a day, seven days a week!

Under these circumstances, then, it's easy to see that your tools will get little, if any rest . . . . that they must produce *accurately, swiftly* and *safely,* without time-off for repairs due to structural faults or breakdowns. Ideal, then, is such a situation for SPRINGFIELD Geared Head Lathes' superior qualities of both construction and design.

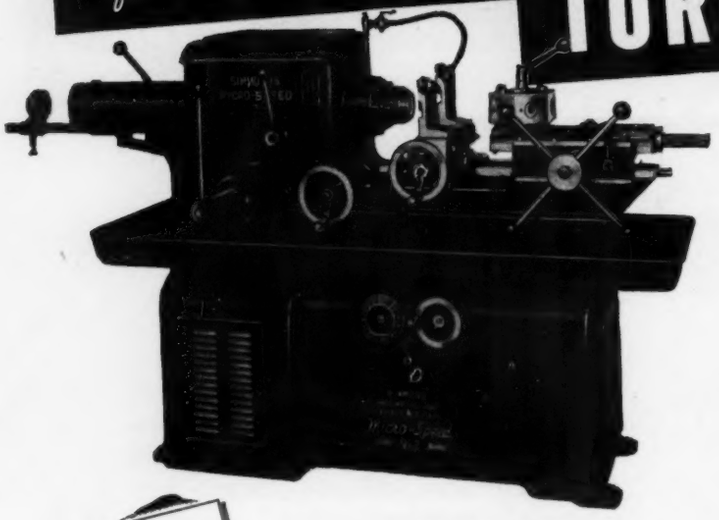
Don't hesitate in letting SPRINGFIELD's carry your production load. All along the bed, from headstock to tailstock, they excel in basic materials, gearing arrangements, attachments, lubricating systems and power transmission. Sizes, too, are completely varied . . . there's one to meet almost every requirement.

Get this "twice-around-the-clock" service that SPRINGFIELD offers. Make every hour of the day more productive and less costly as to lathe maintenance and upkeep. A letter today will bring complete SPRINGFIELD Geared Head Lathe price and size specifications. Write!

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.

More Shells for the 37's... with SIMMONS NO. 2 TURRET LATHES



SIMMONS No. 2 Turret Lathes are being used in important war production plants all over the country —working on shells for 37 mm guns, turning out myriads of small parts for our fighting aircraft, performing a wide variety of bar and chucking operations that require high precision at high speed.

Designed for simplicity of operation, with a minimum of confusing devices, these Simmons Turret Lathes make it easy for even inexperienced operators to produce high-precision work quickly. For example, the Micro-Speed Drive offers unlimited speed changes and all variations can be made while the spindle is in operation. This enables quick selection of the speed best-suited to the work and cutting tools. A simple oversized brake brings the spindle to rest quickly.

Write today for descriptive bulletin and complete specifications. Our delivery schedule is reasonably quick.

SPECIFICATIONS

1¼" Bar Capacity 14" Swing
Built in Plain and Back-Geared Types

FOR USERS OF
SIMMONS TURRET LATHES

This Parts and Maintenance Manual will prove a valuable aid in helping you to keep your Simmons Turret Lathe operating at peak efficiency. To get your copy, send us the serial number of your machine.

SIMMONS MACHINE TOOL CORPORATION

Main Office: 1759 NORTH BROADWAY, ALBANY, N. Y.

New York Office: 149 BROADWAY

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES

HOW TO GET THE MOST OUT OF YOUR LATHES

No. 1 in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient war production.

Keep Your Lathes Clean

Yes, it's as simple as that. Just by keeping your lathes (and other machine tools) clean, you can increase production, reduce scrap, and lengthen the life of your equipment.

This will not only benefit you, but it will be a definite contribution to our total war effort. For every available machine tool must be kept going. The combined output of all machine tool builders cannot supply enough equipment to keep pace with the rapidly expanding war production program, so there can be no unnecessary replacements.

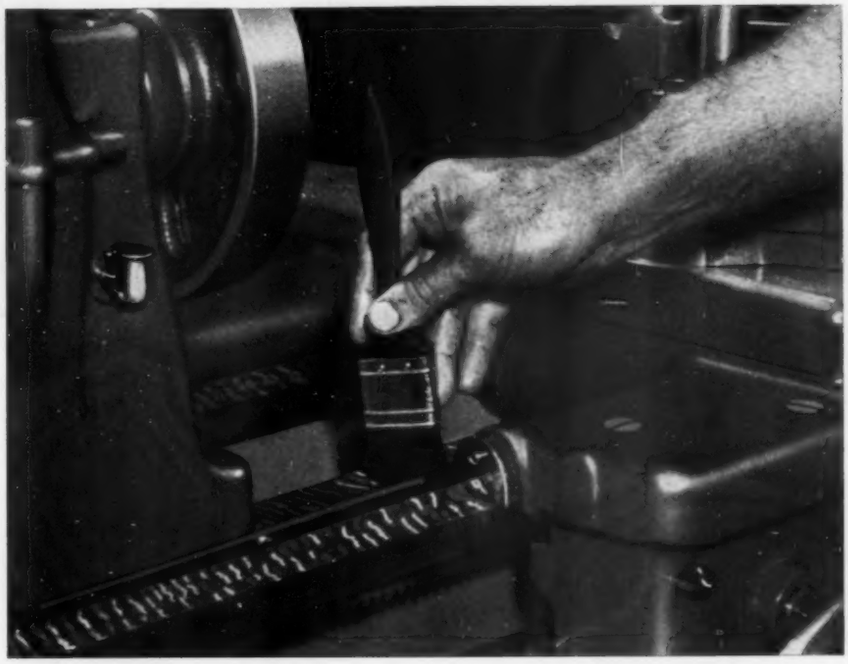
Dirt Is Abrasive

Unless brushed away frequently, the scale, grit and fine chips produced by the cutting tool mix with the oil on the bed ways, dovetails and other bearing surfaces, forming a dirty sludge. Because this dirt is abrasive, it increases friction and causes wear wherever it is allowed to collect.

Obviously, this retards production, shortens machine life, and makes it hard for the operator to maintain exacting tolerances. And when chips work under the tailstock or saddle, or into the spindle taper, the accuracy of the lathe may be seriously impaired.

Encourage the Operator

A good way to keep your lathes clean is to encourage each operator to take care of his own machine. Let him know that you appreciate his interest and effort. Explain how easy it is to spot a good machinist by the way he takes care of his lathe. Urge him to take pride in keeping his lathe clean, free from dirt and chips. He will have greater respect for his job and will unconsciously become a more careful workman.



A small paint brush is convenient for brushing away dirt and chips

A small paint brush is convenient for brushing away loose dirt and chips. Compressed air is not so good because it may blow dirt and chips into oil holes and bearings. Pliers are handy for pulling long steel shavings away from the machine. A clean cloth can be used, after brushing, to remove the last traces of dust and grit. A little oil on the cloth will prevent rust from forming on the finished surfaces of the machine.

The felt wipers on the ends of the saddle wings should be removed and cleaned in kerosene occasionally. An experienced machine tool service man should periodically inspect the lathe and remove any grit or chips that may have worked under the saddle or tailstock. The bed ways can be badly scored by a small steel chip imbedded in the saddle or tailstock base.

Don't Let Chips Collect

Adequate chip disposal should be provided to prevent chips from piling up underneath or around the lathe. Dirt and chips should not be allowed to work into the threads of the lead screw or the gearing of the apron or quick change gear box.

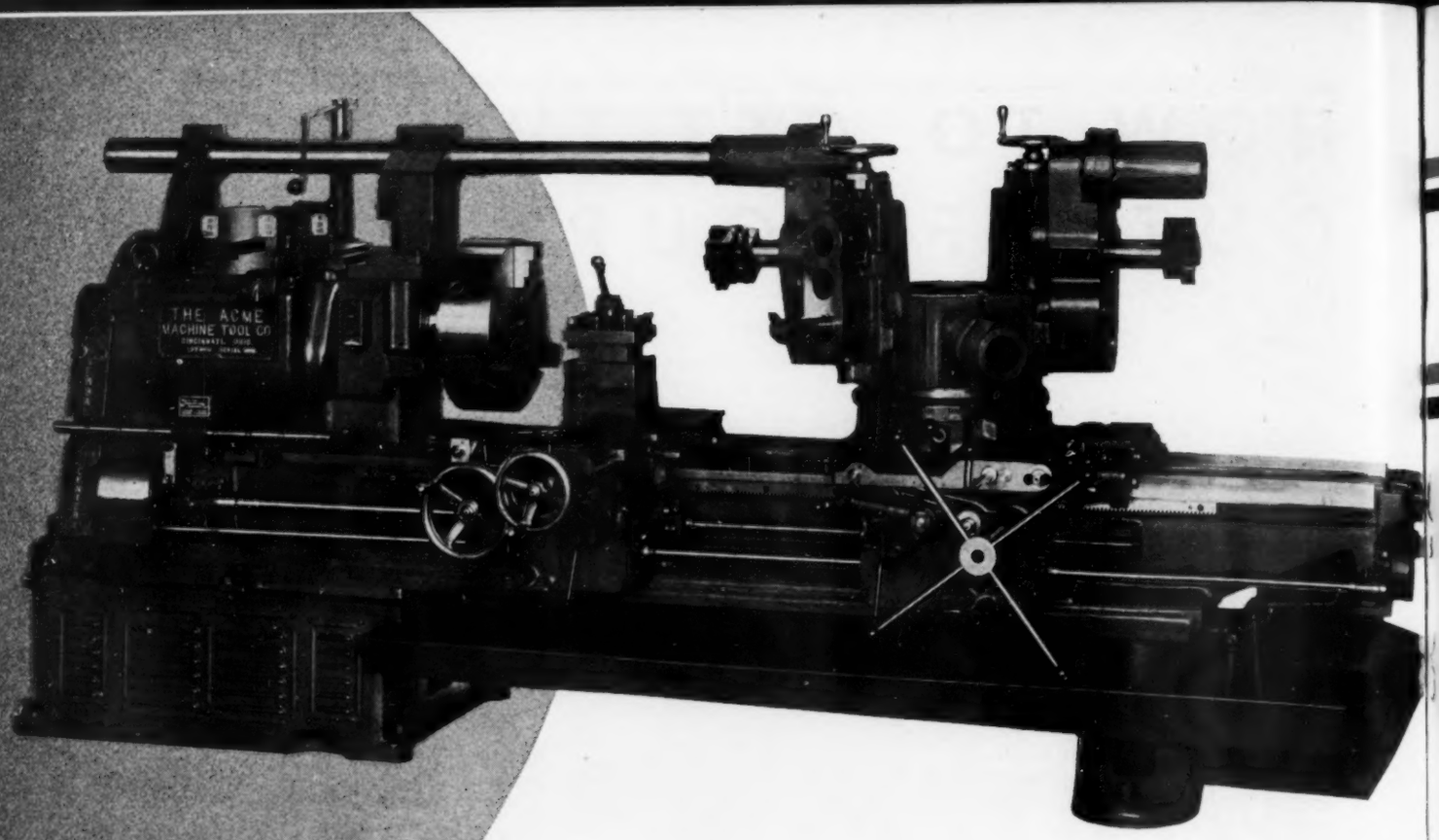
At a time like this, when most machine tools are operating 24 hours a day at speeds and feeds far beyond those for which they were designed, a small amount of carelessness may cause excessive wear — even a breakdown. Certainly an ounce of prevention is now worth far more than a pound of cure.

Write for Bulletin H1

Bulletin H1 giving more detailed information on the cleaning and care of the lathe will be supplied on request. Reprints of this and other advertisements in this series can also be furnished. State number of copies wanted.

SOUTH BEND LATHE WORKS

Dept. 232 • South Bend, Ind., U. S. A. • Lathe Builders for 35 Years



CINCINNATI ACME

RESPONDS TO INCREASED DEFENSE EFFORT WITH THE *NEW 3S-ACME* UNIVERSAL TURRET LATHE!

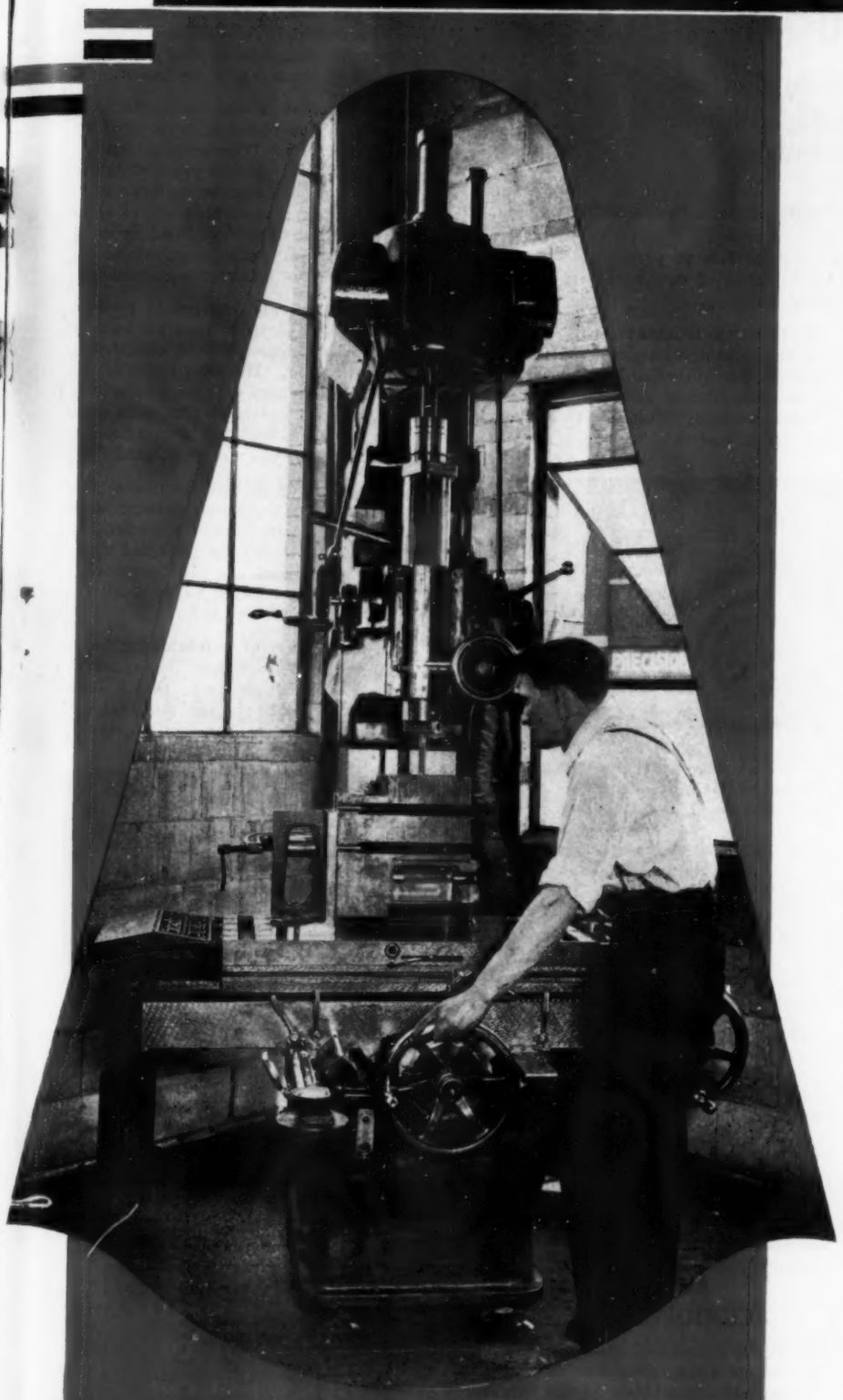
• The 3S-ACME is a machine of improved design and large capacity with abundant power and rigidity plus ample speeds and feeds to meet demands of carbide and other high production tools so necessary to speeding up defense operations.

This ACME features a stationary overhead pilot bar which not only makes for increased accuracy but for speeding up operation on jobs requiring rigid support to cutting tools. Another advantage is the safety factor, as there is no overhanging bar projecting from the turret to cause trouble for operator.

It is built in 24" and 28" Swing for chucking work and up to 4¼" diameter Bar Capacity.

The ACME MACHINE TOOL CO.,
... CINCINNATI, OHIO.

Fosdick Jig Borer



BRINGS PRODUCTION ECONOMY TO TOOL and DIE SHOP OPERATIONS

One of the outstanding features of the Fosdick Jig Borer is its adaptability to a wide range of operations on jigs—fixtures and tools.

Here's a machine, moderately priced, capable of handling a wide variety of work at surprisingly low costs.

It is particularly suited to Tool and Die Shop work. Today when every minute counts, hundreds of these shops are using Fosdick Jig Borers to meet urgent demands of war industries — quickly — accurately — and economically.

If yours is a job for a jig borer put it on a Fosdick. Complete detailed description will be found in Fosdick Jig Borer Bulletin J.B.A. Want one? Write.

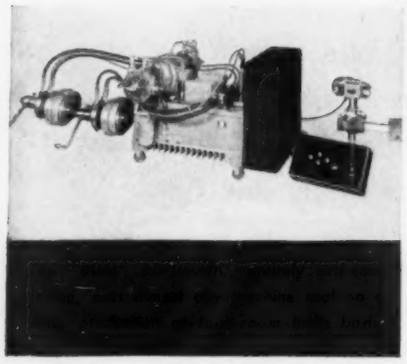
FOSDICK MACHINE TOOL COMPANY
CINCINNATI ··· OHIO

How to Get MASS PRODUCTION from TOOL ROOM TOOLS

High Speed Production at Tool Room Limits Without Specially Built Machinery

Many of the nation's foremost manufacturers have been faced with the novel necessity of producing ordnance on a combination precision-mass production basis with tool room tools. Limits of accuracy previously never expected outside the tool room have been required. This, together with the necessity of using relatively unskilled help, presented an almost impossible problem.

To make ordinary tool room machine tools and "green" help



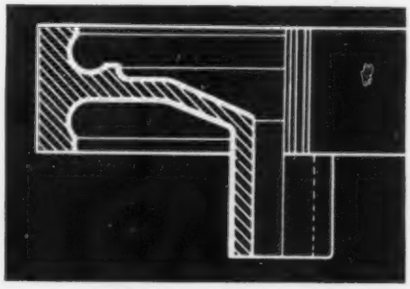
"do the impossible", however, has become an accomplished fact.

Separate machine tool controls have placed many of the operations on a full automatic basis; the most skilled of their operators have been released for work of greater importance. The elimination of the necessity for increased floor space and excessive long waiting for specially built equipment has been entirely obviated. These machine tool controls, DUPLIMATICS, manufactured by the Detroit Universal Duplicator Company, are now being used throughout the country on war goods production exclusively. The type of work that can be handled is described as follows.

AUTOMATIC CONTOUR TURNING

This sketch shows a thin section propeller gear housing which was of too intricate contour to be machined by manual operation, too thin to be done with forming tools. Also, too few a number were required too fast to permit the designing and building of equipment for this one operation alone.

A "DUAL" DUPLIMATIC was connected with the cross and longitudinal feeds of a standard Reed-Prentice lathe. Both feed screws are turned automatically and simultaneously as required to feed the cutting tool in and out.



The work is chucked in the usual manner. A template of the exact size and outline of the finished work is fastened to the cross feed carriage. A tracer, clamped to the lathe bed, is adjusted so that its stylus can contact the template. The moment the operator starts the lathe and touches the starting button on the control panel of the DUPLIMATIC, the latter "takes over" entirely on a full automatic basis—moving the cutting tool automatically along the exact path of the finished work.

Since the operation is entirely automatic and since the feed on both screws is simultaneous and graduated in extremely fine increments, blending of radii is certain and even the straight portions of the work is of such fine finish that very little hand-finishing is required. DUPLIMATICS have shown an increase of 7 times the production possible with manual control. Moreover, a decided decrease in hand-finishing and scrapped parts has resulted.

AUTOMATIC CONTOUR MILLING

Milling the contour of aircraft connecting rod cavities is now being done on standard vertical milling machines. In this instance, there was no waiting for special equipment, nor any special training required for the operators of the machines. This operation, while requiring the close-finish of tool room die sinking work, has to be done at speeds impossible with manual operation alone.

The "DUAL" DUPLIMATIC, identical with that used for the contour turning mentioned above, turns the longitudinal and cross feed of the milling machine table. (If the depth of cut also had a contour or variation, a "THREE-WAY" DUPLIMATIC instead of the "DUAL" DUPLIMATIC would have been required.) A template is mounted on the table alongside so that it can be contacted by the stylus of the tracer.

This operation is also automatic, excepting that the operator is required to touch one of four "change-of-direction" buttons on a handy control panel when the milling operation is negotiating a corner of the work. Exceptional blending of radii has resulted in reduction of hand-finishing as compared with that required before the "DUAL" DUPLIMATICS were installed.

The DUPLIMATIC equipment used in this work is an entirely separate control mechanism which can be used with almost any machine tool. The advantages of the use of DUPLIMATICS are that no specially built equipment is needed; tool room tools can continue to hold the accuracies for which they were originally designed.

Specially trained operators are not needed. Usually the same operator, with a few hours' instruction, carries on. In some instances, relatively unskilled operators have replaced the old operators—the latter being released to do work requiring their particular skills.

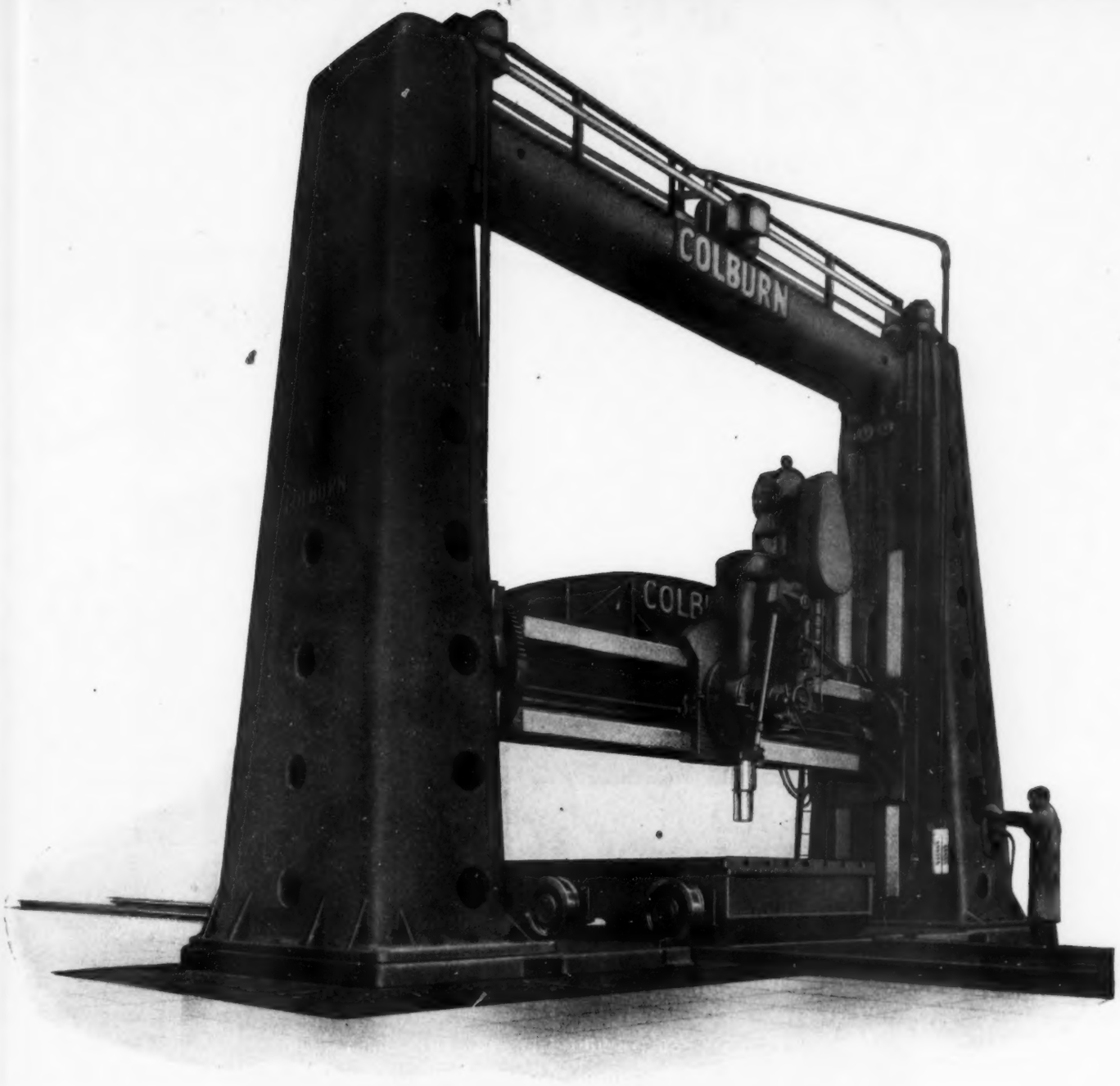
The installation of DUPLIMATIC on a machine tool does not limit that machine to automatic duplicating only. The DUPLIMATIC can be quickly "de-clutched" from the feeds to permit manual operation.

DUPLIMATIC machine tool controls are used in some of the largest mass production shops in America, producing: TORPEDOES—BOMBS—MACHINE GUNS—AIRPLANE ENGINE PARTS—TANK TURRETS—ANTI-AIRCRAFT GUNS—AIRPLANE LANDING WHEELS.

Ask for complete information NOW.

DETROIT UNIVERSAL DUPLICATOR CO.
231 St. Aubin Avenue
Detroit, Michigan

★ COLBURN ARMOR BOLT DRILLING MACHINE ★



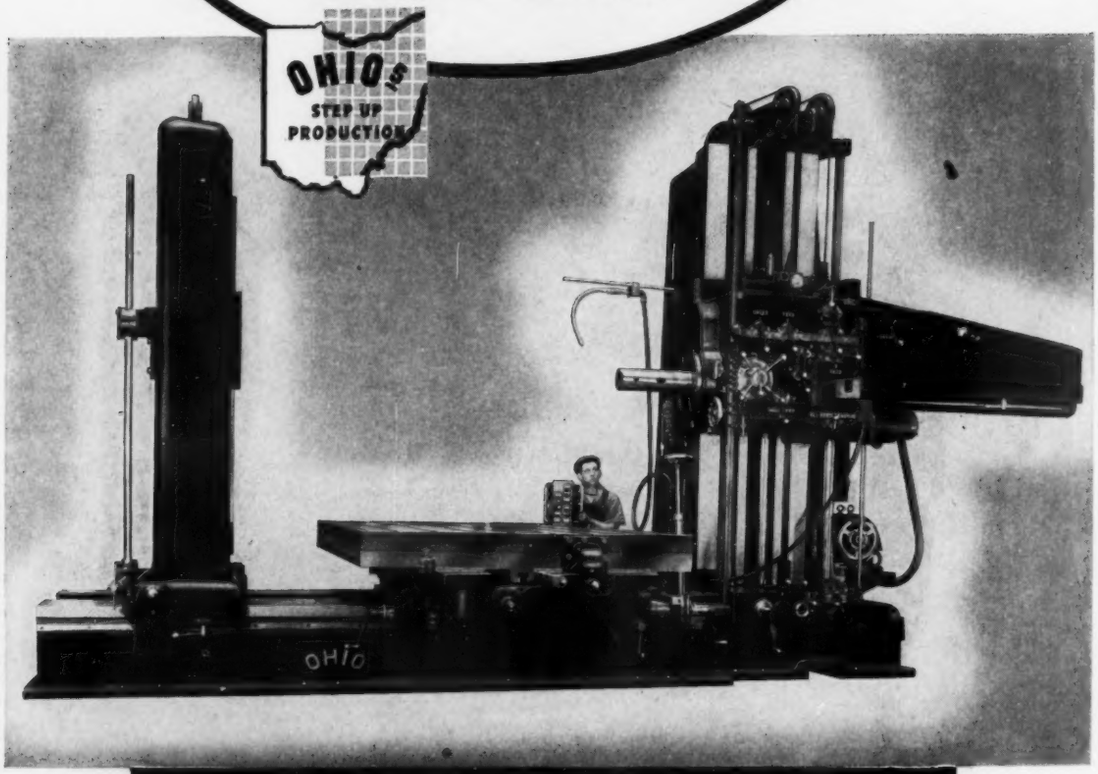
The 150-ton machine tool shown above is typical of the size and weight of machine tools required in the Victory program. It is one of a number Consolidated is building. It is a special Universal Drilling and Boring Machine. It is used for drilling and threading holes in heat-treated steel armor plate for battleship construction and gun turrets.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

OHIO HORIZONTAL

BORING, DRILLING AND MILLING MACHINES



● Here is a new and larger Dreadnaught with all the power, precision and convenience you have learned to expect of these machines. Maximum specifications: 72″ x 132″ table, 60″ wide bed, from 10′ to 20′ between face plate and bar support, 96″ vertical travel of spindle head, 72″ continuous spindle feed. You have anti-friction bearings, automatic lubrication, portable push-button control, unit construction—*every worth-having feature.* Available also in the floor type with corresponding characteristics and a wide range of specifications to meet every need.

THE OHIO MACHINE TOOL COMPANY • KENTON, O.

OHIO DREADNAUGHT

HORIZONTAL BORING, DRILLING AND MILLING MACHINES • SHAPERS • PLANERS

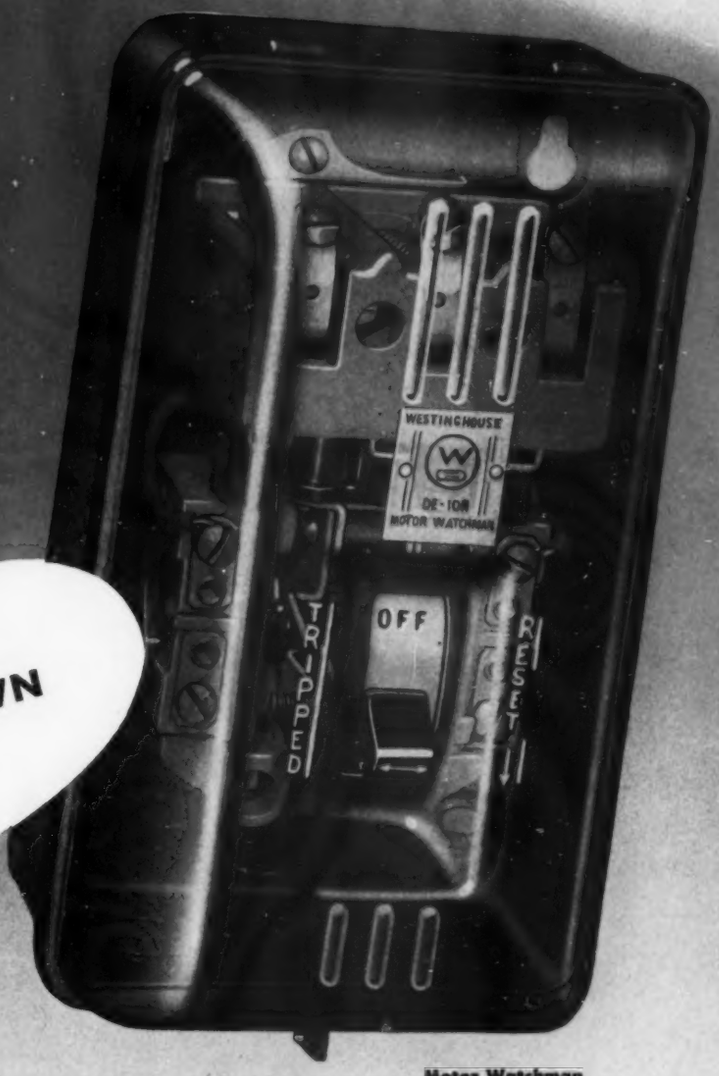
HERE'S WHY

QUICK-MAKE QUICK-BREAK

HELPS KEEP

PRODUCTION **up...**

maintenance DOWN

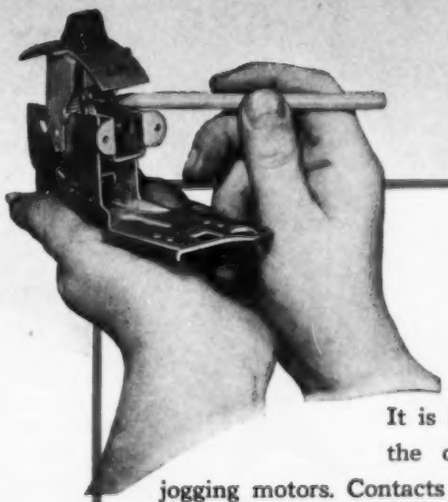


Motor Watchman
Class 10-100, Size 1

Westinghouse "De-ion" Motor Watchman Manual Starters for a-c Motors up to 7½ hp.

Quick-break action alone in a motor starter is not enough. For long uninterrupted life, it is important to have quick-make action, too. Westinghouse "De-ion" Motor Watchman has both. No matter how slowly the toggle switch handle is raised to the "ON" position, as soon as it passes center, the positive-acting mechanism instantly exerts full pressure on the contacts. There is no chance of contacts carrying the full starting load before they are latched together tightly. This two-way protection against arcing minimizes pitting and burning, increases contact life. For complete information write for descriptive folder. Address Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-21188-A

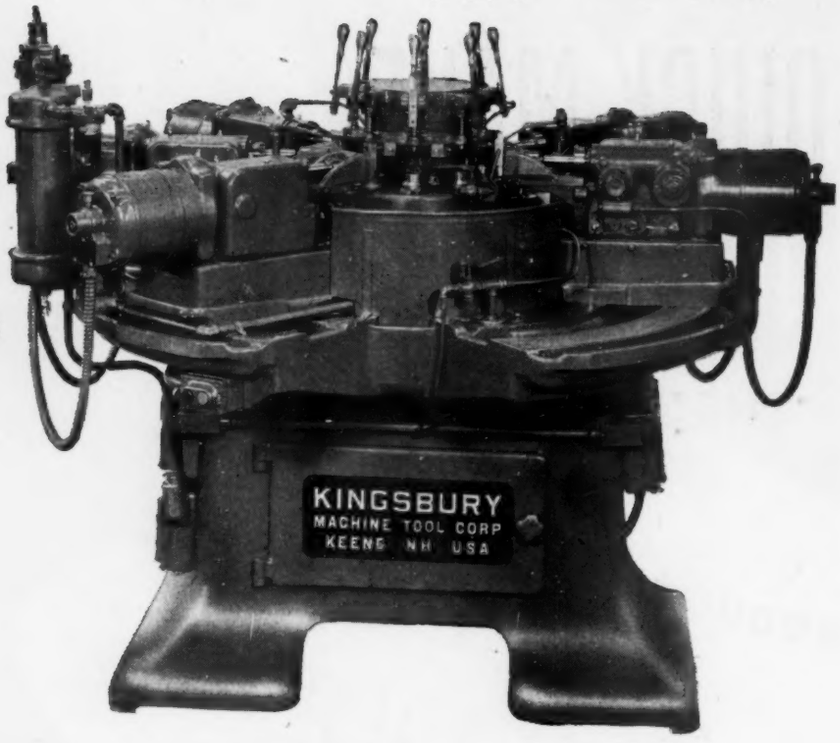


SPRING ACTION PREVENTS "TEASING"

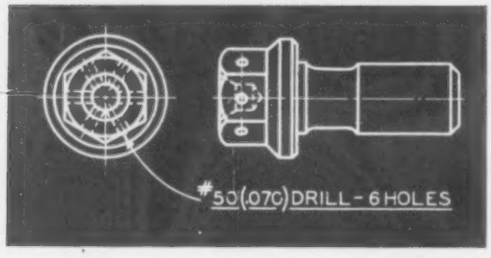
It is impossible to "tease" the contacts, even when jogging motors. Contacts cannot be held partially closed. Two heavy steel springs which are under a constant 20-pound tension, give the positive quick-make quick-break action.

Westinghouse

Loading and Unloading While Drilling assures Continuous High Production



FLEXIMATIC



by KINGSBURY

THIS IS A FLEXIMATIC AIRPLANE JOB!

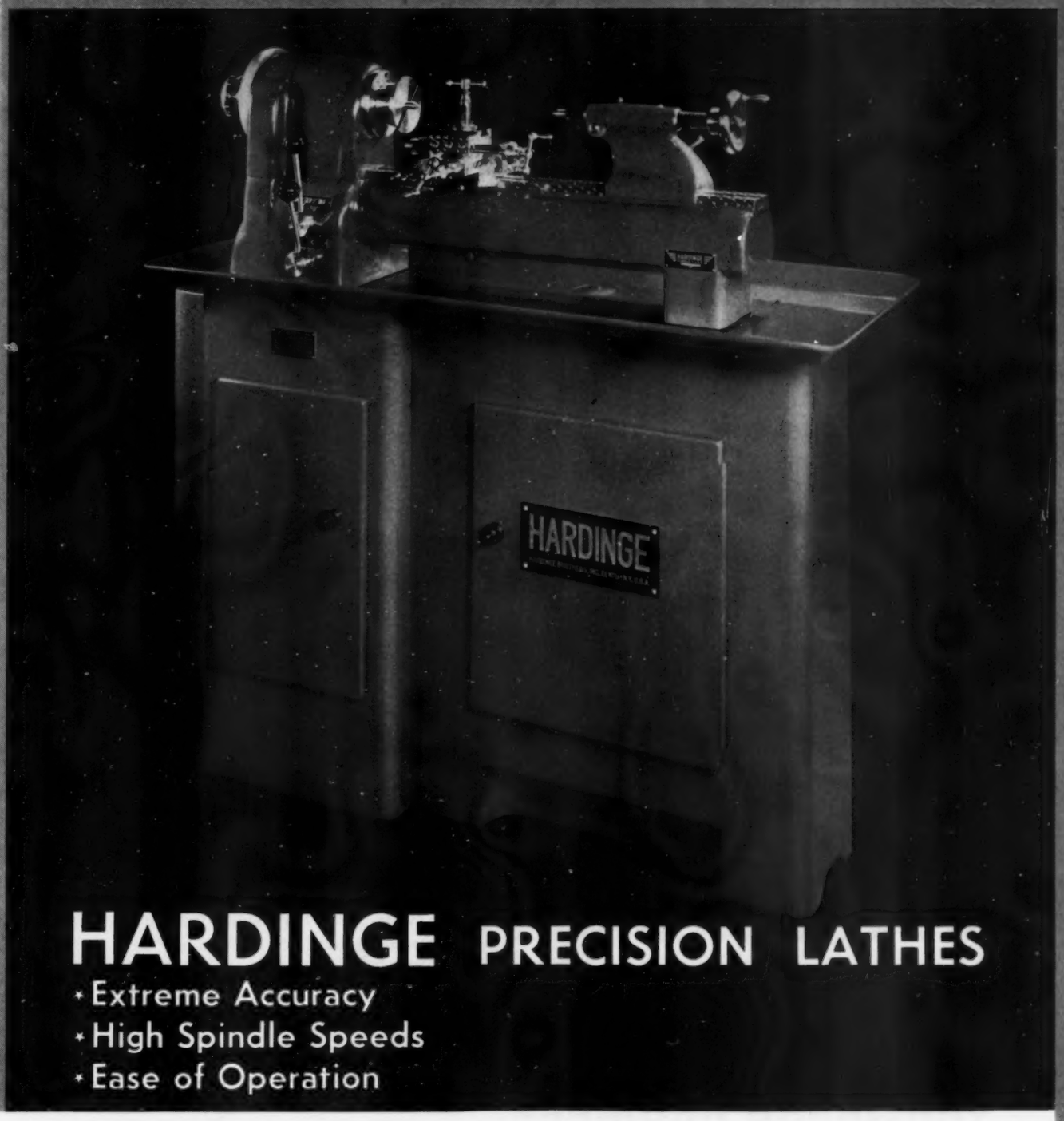
Kingsbury Standard Units for drilling, reaming, boring, spotfacing and milling can be mounted in any combination, operated automatically and changed over quickly and easily to suit the requirements of the work to be handled.

This six-spindle FLEXIMATIC is set up for drilling lacing holes in the heads of screws for airplane motors. High production, so essential to parts involved in the speeded up program of this important phase of National Defense, is being achieved with minimum effort on the part of the operator.

The main turret of this FLEXIMATIC contains eight individual turrets which index 60° at each index of the main turret. Each of the six automatic drilling units on the machine drill a hole from the outside face of the hex head into the center only. The operator merely loads and unloads at the loading station while the holes are being drilled at the other stations on the machine. All six drilling operations are performed in a single chucking of the work.

Speed, convenient handling, accuracy and continuous production are universally recognized advantages offered by FLEXIMATICS regardless of the nature of the job assigned them to handle. The specific work being performed here is typical of many others where FLEXIMATICS are the machines for jobs calling for the maximum in time savings.

KINGSBURY MACHINE TOOL CORPORATION
KEENE NEW HAMPSHIRE U S A



HARDINGE PRECISION LATHES

- Extreme Accuracy
- High Spindle Speeds
- Ease of Operation

HARDINGE Precision Lathes combine these three important requisites for production:

Extreme Accuracy for the close tolerances demanded by today's rigid manufacturing standards.

High Spindle Speeds mean greater production and a better finish.

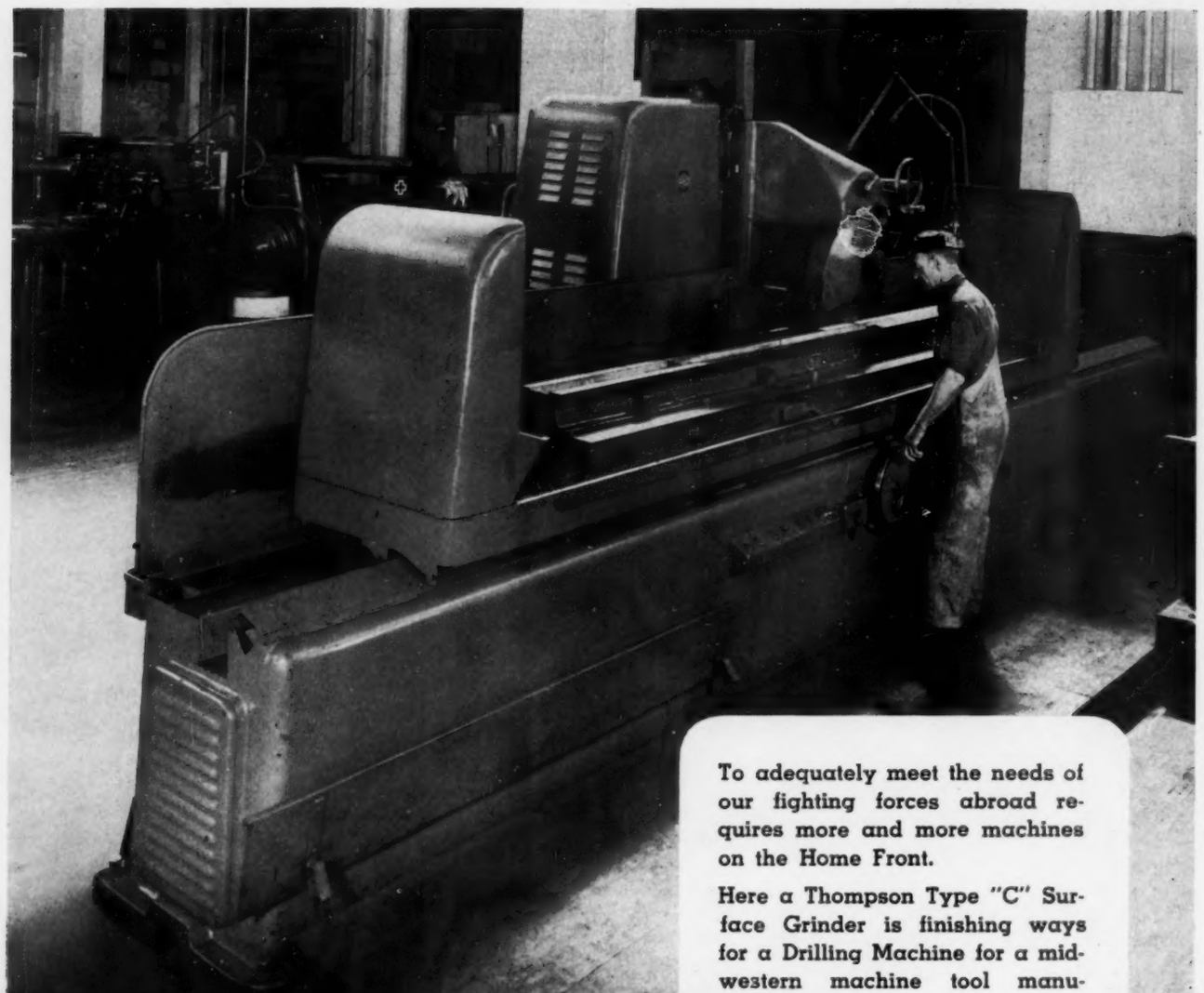
Ease of Operation enables relatively unskilled operators to produce parts to the necessary close limits without expensive tooling.

SPECIFICATIONS: 1" collet capacity, 6" step chuck capacity, 5" jaw chuck capacity, 9" swing, 36" bed, lever speed control with spindle brake; 8 speeds forward and 8 speeds reverse from 230 to 3900 R.P.M.

"Performance has established leadership for **HARDINGE"**

HARDINGE

HARDINGE BROTHERS INC., ELMIRA, N.Y., U.S.A.



To adequately meet the needs of our fighting forces abroad requires more and more machines on the Home Front.

Here a Thompson Type "C" Surface Grinder is finishing ways for a Drilling Machine for a midwestern machine tool manufacturer.

The full hydraulic operation of Thompson Grinders not only assures greater accuracy but an extremely smooth surface as well. This is evidenced by grinding the ways of 4 pieces simultaneously on the machine shown.

For dependable accuracy on "round-the-clock" production put your surface grinding jobs on a Thompson Grinder. Bulletin giving full details sent on request.

MORE MACHINES FOR THE HOME FRONT

★

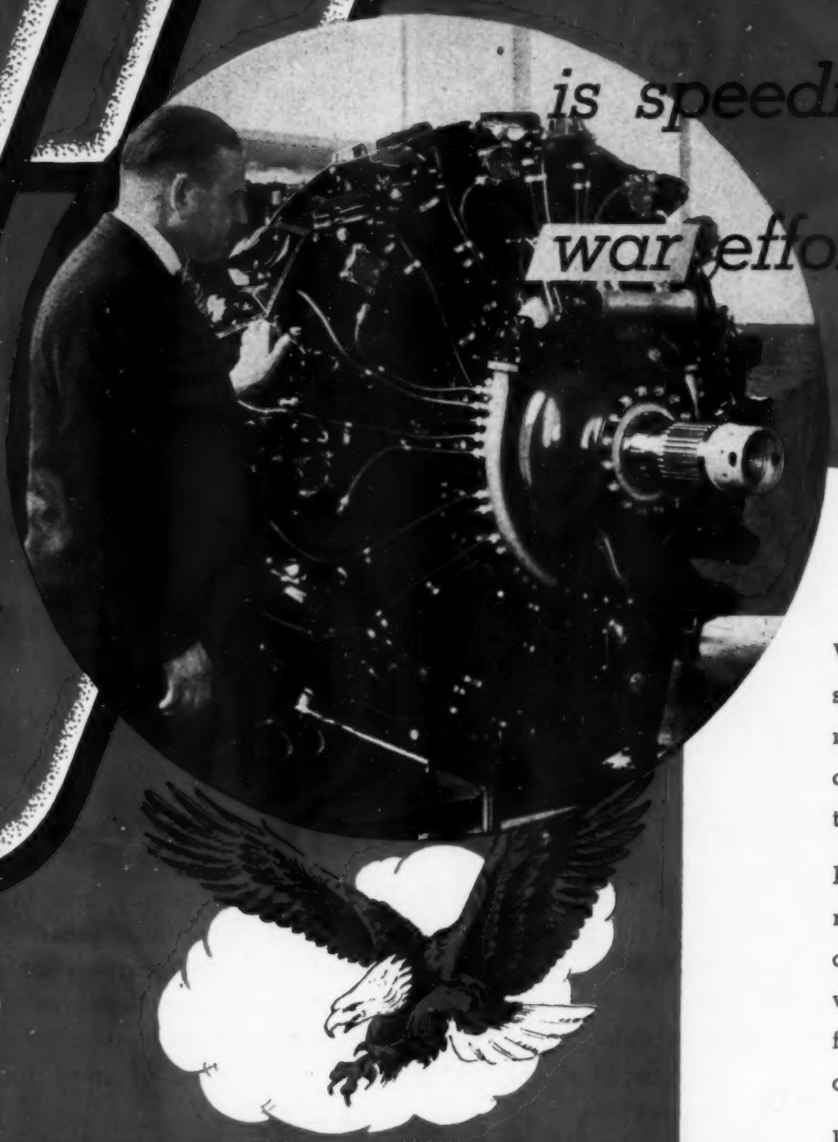
THOMPSON GRINDERS

THE Thompson GRINDER CO.

SPRINGFIELD, OHIO

AUTOMATIC CHUCKING EQUIPMENT

is speeding the great war effort . . . . .



With the battle of production resolving itself into a battle against time, any equipment which can turn out more work hour after hour is making a real contribution to today's most urgent needs.

Potter & Johnston Chucking Equipment is not only making time savings in the duplication of parts but is also turning out parts which meeting the most rigid specifications for accuracy, are ready for assembly without delay.

Potter & Johnston machines are in use today producing airplanes, airplane engines, tanks, Bofors guns, 90 mm anti-aircraft guns, machine guns, adaptors for shells, the American Oerlikon gun and other vital implements of defense.

Ease and convenience in handling even intricate operations at top speed on P&J equipment is a further contribution by Potter & Johnston in helping speed the war effort.

The POTTER & JOHNSTON MACHINE COMPANY

PAWTUCKET . . . . . RHODE ISLAND

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws—End Mills—Taps—Dies—Screw Plates —Profile Cutters—
THE TOOLS YOU BUY AGAIN

Try them on the basis of ASSURED *better performance . . .*

Shop after shop has come to recognize the ruggedness, accuracy and fast cutting action of UNION TOOLS after proving them out on difficult jobs.

There is sound reason for the better performance of these cost cutting tools. One of these reasons is the *experience behind them*—an experience that involves years of research, as well as outstanding technical, metallurgical and manufacturing facilities second to none in the field of small tool production.

Because Union has the means for producing tools of the finest quality and concentrates every resource on achieving highest performance standards on all tools bearing the name "UNION", users of UNION tools can always be certain of efficient, economical service.

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS
S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

UNION

Wartime Problems

ROUND THE WORLD EVERY 8 DAYS!

That's the rim-travel of a rotor in many electric motors now working all around the clock on Victory production!

Motors that worked 1800 hours in a peacetime year are now working a full *8700 hours a year.* Result: problems of maintenance are *quadrupled.* And more...

For motors must receive *finer* care than ever. Whose motors last longest may have a lot to do with who *wins* this war!

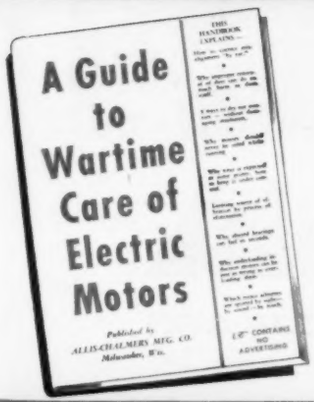
CALL FOR Wartime Solutions

AN ATTACK IS THE BEST DEFENSE

Taking the initiative against wear always has been sound maintenance practise. In wartime, it's a *vital* practise!

First, because wear now works *faster.* Second, because avoidable breakdowns *cannot be afforded* in the victory effort!

Beating wear to the punch is the basic principle of a new Allis-Chalmers publication: "A Guide to Wartime Care of Electric Motors." You'll find it *invaluable!*


A Guide to Wartime Care of Electric Motors
Published by ALLIS-CHALMERS MFG. CO. Milwaukee, Wis.
THIS HANDBOOK CONTAINS NO ADVERTISING

Order This Free Book!

Every engineer, production manager and maintenance man will want a copy of "A Guide to Wartime Care of Electric Motors" for his technical library—and for immediate use, too!

It outlines the "natural enemies" of an electric motor and the most effective methods of combatting them. To be of maximum use to you, it applies to *all makes* of standard, general-purpose motors.

It's liberally illustrated — contains no advertising.

Tear out the order form now and send in to Allis-Chalmers for *your* free copy of this timely handbook.

ALLIS-CHALMERS MFG. CO.
Advertising Dept.
Milwaukee, Wisconsin

Gentlemen:

Yes, I would like to receive *free of charge* "A Guide to Wartime Care of Electric Motors."

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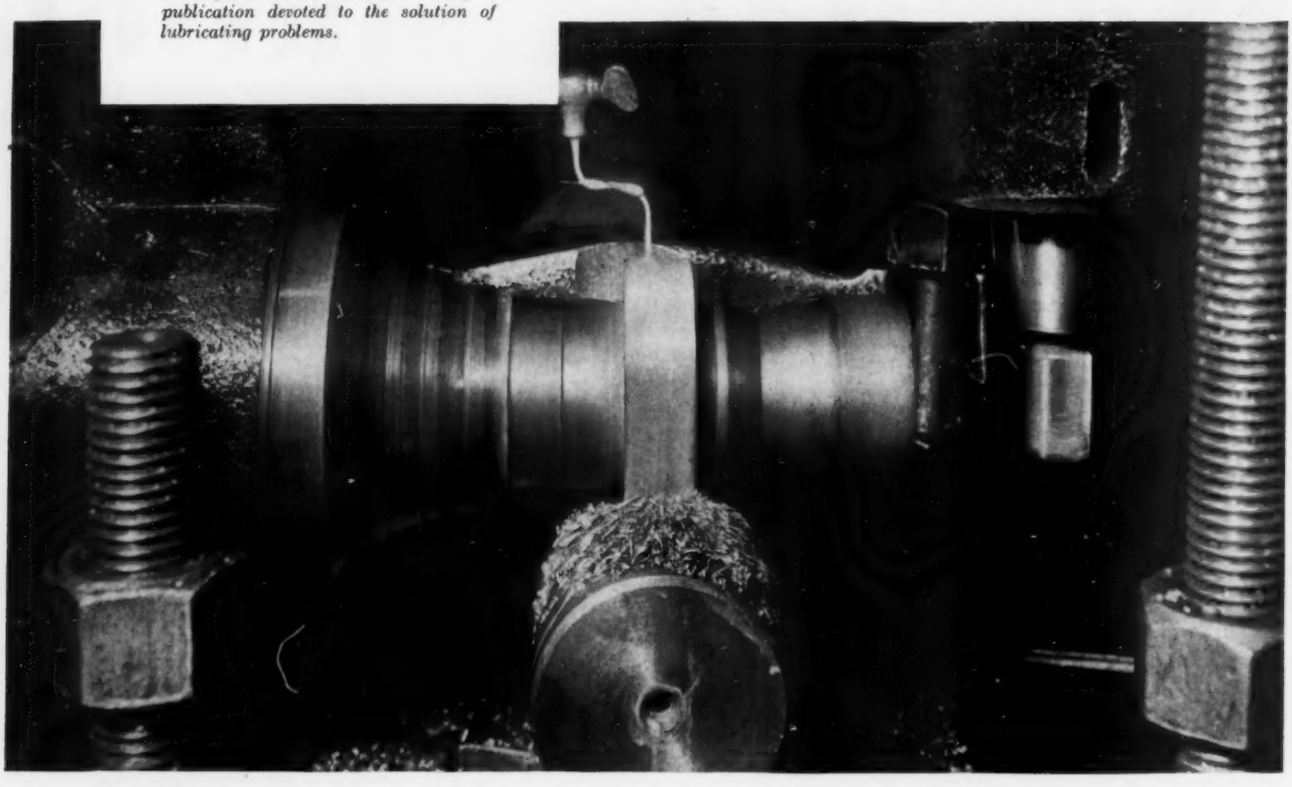
ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE

FRONT LINE MIGHT rests on rear line production. *MACHINING* output at faster speeds with fewer tool regrinds is offered by use of...

...SINCLAIR CUTTING OILS AND COOLANTS. These oils are designed for clean cutting, high finish, and low cost per unit machined.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



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FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

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2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

CHIPS... in the biggest poker game the world has ever known

THESE are the chips that will win the game of war . . . the chips that curl off the cutting tools of American machines. Pictured below is a hundred-thousandth-of-a-second interval in a normal 24-hour day during the life of a P&W Curvex Cutter . . . milling a recess in an aircraft engine housing. It's sharp, clean cutting, moving fast even though our "frozen-action" camera "stopped" it cold. Those thick, husky teeth are almost new — but they can be reground again and again, down to thin wafers, before their useful life ends. Many hundreds of engines will have felt their precision bite.

That's *service* from cutting tools. It's building American *strength* in the air.

Don't worry about your Pratt & Whitney cutting tools . . . bear down . . . they can take it.

P&W Photo—Unretouched

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

What About Your Tool Steel Scrap?

Get in the Scrap
FOR VICTORY

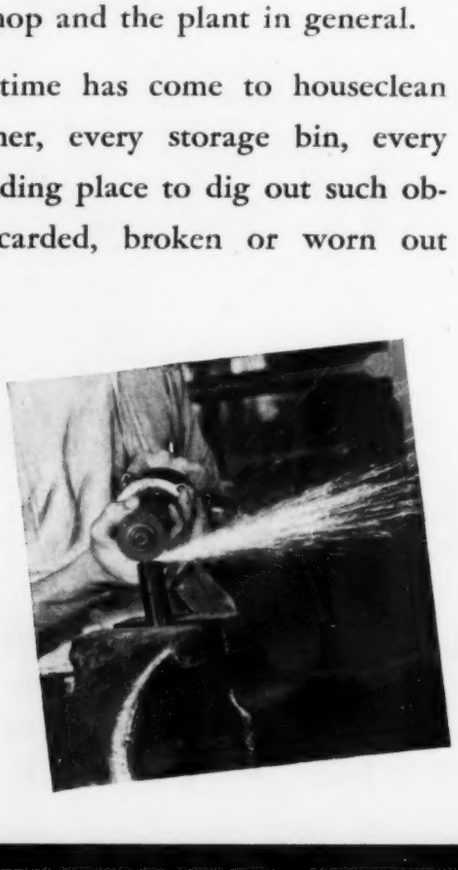
BEFORE you say you haven't any around your plant . . . think a moment! In almost any plant, over a period of years, things accumulate.

For example, obsolete dies, tools, jigs and fixtures made of carbon and alloy tool steels get put aside in some storage corner. Broken or worn out tools can be found in odd places throughout the tool room, machine shop and the plant in general.

Now the time has come to houseclean every corner, every storage bin, every possible hiding place to dig out such obsolete, discarded, broken or worn out tools. Start them on their way back to usefulness via the scrap route. They are urgently needed to make up the scrap shortage that is curtailing America's war production.

You can render your country a service by organizing a scrap salvage drive in your plant at once. Explore all the departments —collect every bit of metal you can find— don't overlook those old tools—the alloys they contain are vital to war production.

For help in identifying tool steel scrap for salvage, see the Spark Testing Method described on the opposite page.



WHAT TYPE OF TOOL STEEL IS IT?

Spark Testing is one method of finding the answer when separating tool steel scrap for salvage.

The Standard Tool Steels of Industry

Spark Test of STAR-ZENITH (18-4-1) High Speed Steel

This is a typical "high speed steel" spark.

The stream is very scant—the carrier lines are disjointed (1), relatively short, and reddish-orange in color.

Occasional ghost-like secondary carrier lines are present.

Carbon bursts are absent.

Spark Test of SPEED-STAR Moly Tungsten High Speed Steel

Speed-Star differs from Star-Zenith in the following ways:

The spark stream is fuller, having more and heavier carrier lines (1) a shade lighter in color, and varying in length and thickness.

Thicker lines are continuous and gradually swell into bright orange tongues (2) having slight upward or downward curvatures.

There is a tendency for some ghostlike lines to be carried around the periphery of the grinding wheel. A few sprigs (3) and an occasional suppressed burst (4) are visible.

Spark Testing . . . An aid to identifying Tool Steel Scrap

By holding the unknown piece of tool steel against an emery wheel, and watching the pattern of the spark stream, you get a quick indication of the major alloys present. To help your men become familiar with Spark testing, a new Chart has been prepared by our own testing department. Ten different spark diagrams exactly the same size as those above, are shown on the Chart. These diagrams indicate the spark characteristics that identify each Carpenter Matched Tool Steel. With the Chart as a guide, men can readily become familiar with this method of steel identification. Not only is it helpful in separating mixed scrap, but Spark Testing is also valuable in identifying pieces of tool steel that have become mixed in stock. A note on your company letterhead will bring you one of these Carpenter Spark Testing Guides made up in the form of a large Wall Chart 21" x 30" in size—showing the identifying *pattern* of the spark streams.

THE CARPENTER STEEL COMPANY
109 BERN ST. • READING, PA.

Effects of Various Elements on Tool Steel Sparks

Spark characteristics of the following elements are clearly defined on the chart shown below:

MANGANESE — MOLYBDENUM
CARBON — CHROMIUM
SILICON — TUNGSTEN
NICKEL

Instructions are also given for Spark Testing; wheel speeds, effect of wheel grain size, dressing the wheel, etc.

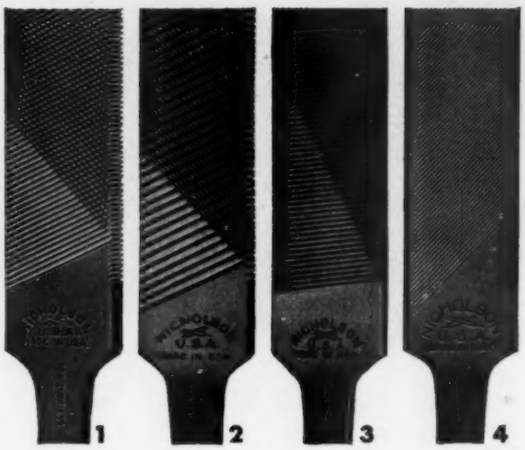
TOOL ROOMS:

This is something that Tool Rooms have long been wanting—a quick reference guide for training men to become more expert in Spark Testing. The tool maker who knows sparks will never waste time or material by making tools from the wrong steels. Send today for this new Tool Room help.

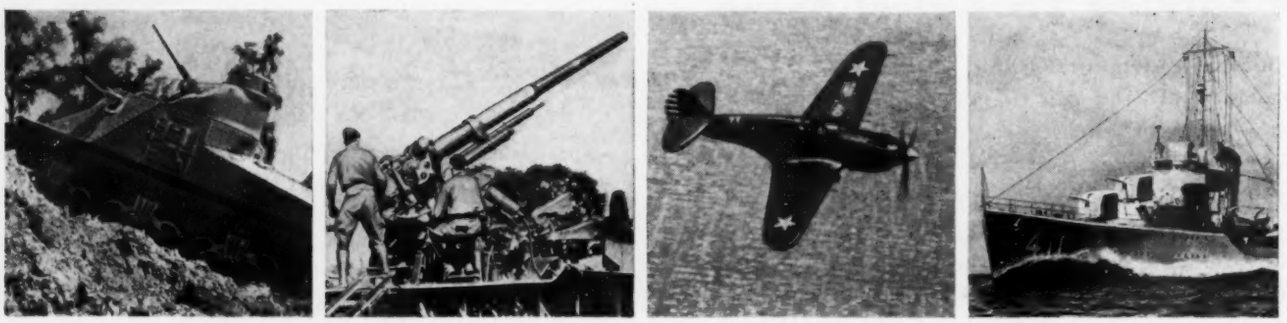
Carpenter MATCHED TOOL STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

The right files for jobs like these



. . . help to speed the right tools



FOR JOBS LIKE THIS . . .

We MUST win this war . . . with maximum output on our production fronts to put maximum equipment on our fighting fronts. There must be top speed and efficiency down to the smallest detail of war-factory operation.

Filing. Because *The right file for the job* is important, Nicholson has set up specific manufacturing facilities for making special files.

Every Nicholson or Black Diamond Special Purpose File has been definitely proved for *added* effectiveness on the work for which it is intended. Four of the more widely used special types are shown above—(1) For Stainless Steel, (2) for Aluminum, (3) for Brass, (4) for Lathe filing. FREE TECHNICAL BULLETINS *on request*.

For your file needs—and further aid in solving filing problems—contact your mill-supply house.

NICHOLSON FILE CO. • PROVIDENCE, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

NICHOLSON FILES
FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U.S.A.

PROMINENT USERS NOW LOOKING TO

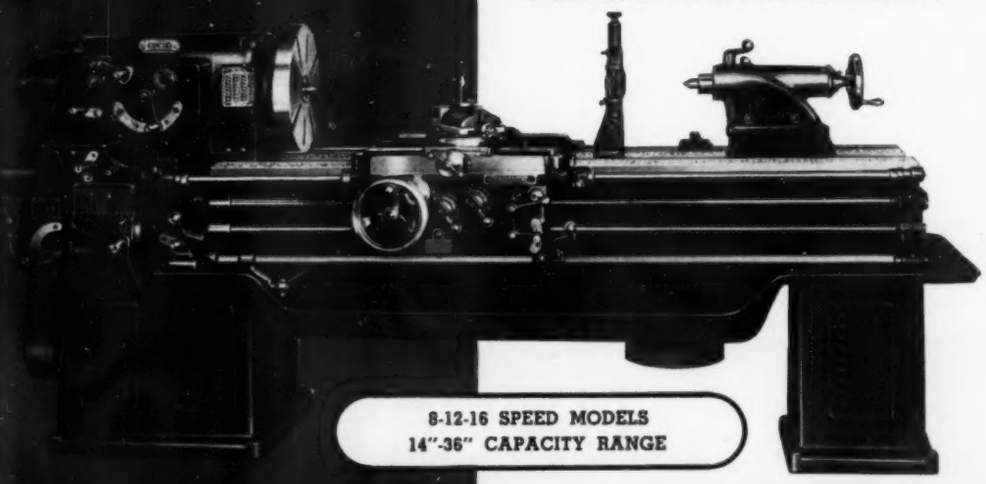
Sidney Lathes FOR "ALL-OUT" WAR PRODUCTION

★Today you must consider machine tools that are designed and built for 24 hour service 7 days a week. Sidney lathe users are in an excellent position to meet the unusual demands now placed on them by the National Emergency.

One of the many features of Sidney lathes is the clutch design and the ease with which selective spindle speeds may be obtained.

Spindle speed changes are made by the use of accurately cut internal and external gear tooth clutches operating on multiple spline shafts with integral keys.

Bulletins available for each model.



8-12-16 SPEED MODELS
14"-36" CAPACITY RANGE

The SIDNEY MACHINE TOOL Company

Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

and Assures Proportionate INSPECTION USEFULNESS

The average wear-resistance of a Lincoln Park chrome plated gage is approximately five times that of a similar steel gage.

Today, thousands of worn gages and non-cutting precision tools are no longer discarded and replaced by new gages and tools in which critical metals are used, and for which many man and machine hours are required in manufacture. Instead they are salvaged by Lincoln Park processes in which they are carefully prepared for plating, are hard chrome plated, and then finished to specified tolerances. When completed, they are ready for a service life far exceeding their original period of service.

In addition, Lincoln Park chrome plated gages can be specified to much closer required limits than steel gages. Because allowances for wear can be reduced considerably, your production departments get the resulting benefits of greater manufacturing tolerances.

It's good business on your part . . . it's a definite contribution to the War Effort . . . to have Lincoln Park put new life and greater usefulness into all of your gages which can be salvaged by chrome-plating.

LINCOLN PARK TOOL and GAGE CO.
LINCOLN PARK, MICHIGAN

YOUR parts are built for maximum strength, highest efficiency, precision and accuracy.

Clearing Press parts are made point for point to same specifications.

Your assembled parts result in planes flying with speed under perfect control with safety and carrying maximum payload.

Clearing Press parts make up presses operating with identical characteristics. Please investigate.

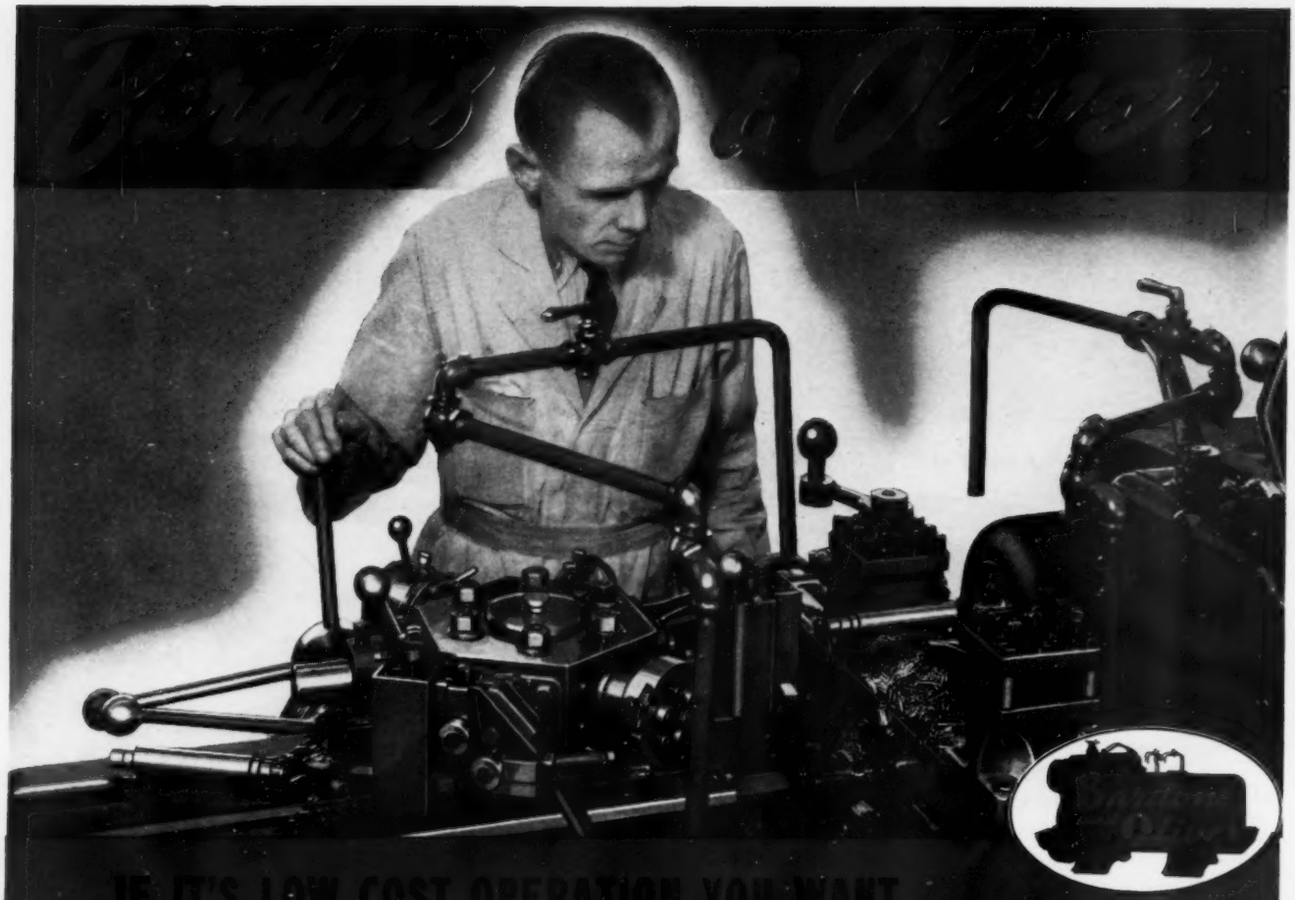
Clearing Machine Corporation
6499 West 65th Street, Chicago, Illinois

MECHANICAL AND HYDRAULIC PRESSES

CLEARING

MACHINE CORPORATION

CHICAGO



IF IT'S LOW COST OPERATION YOU WANT

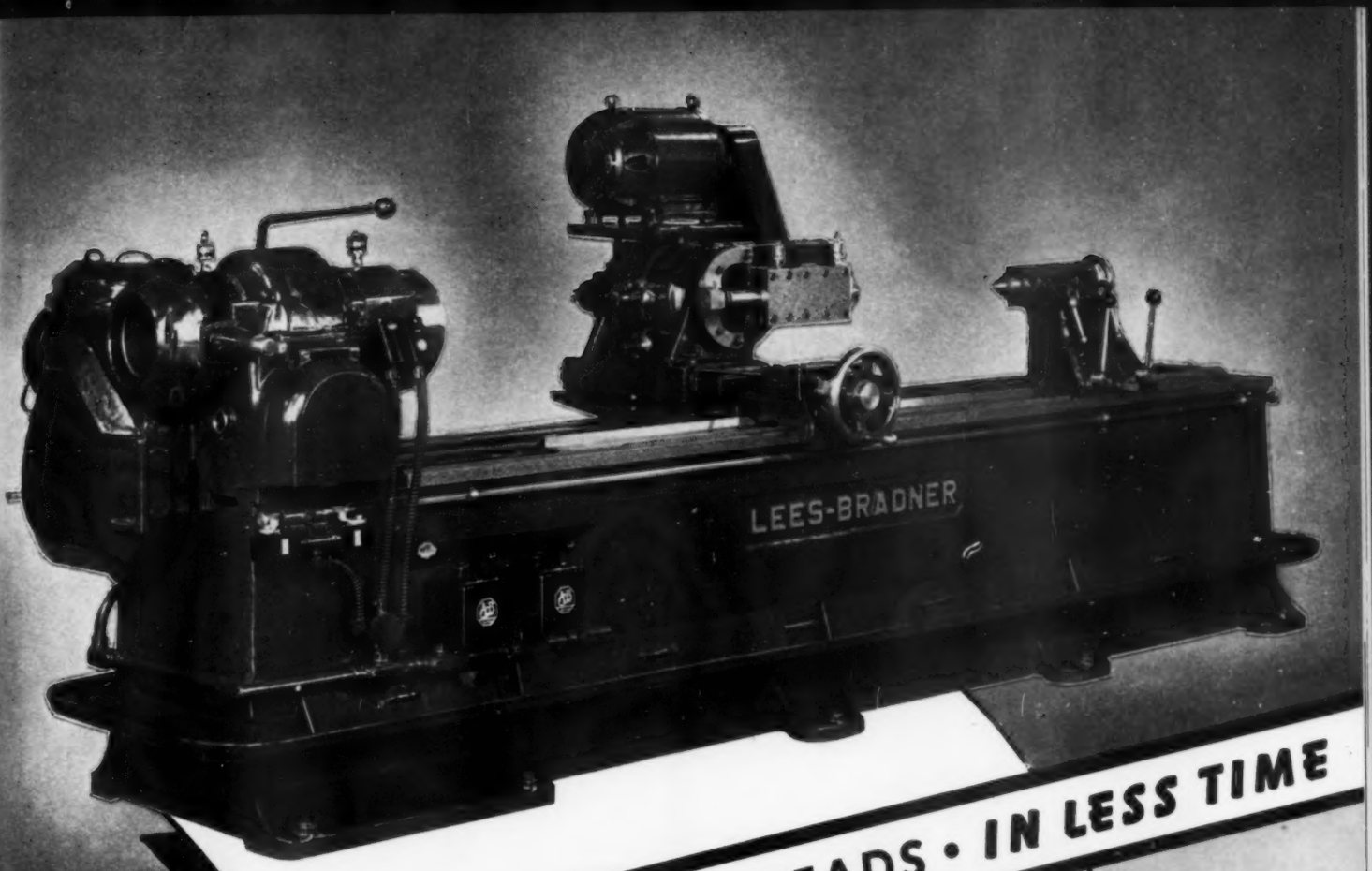
Turn it on a Bardons & Oliver No. 3 UNIVERSAL TURRET LATHE

The production of small parts in large or small quantities at low cost is the result of developing the Bardons & Oliver No. 3 Universal Turret Lathe to its present high degree of efficiency. By concentrating all control levers within convenient reach, and by light and easy manipulation of tool slides and speed and feed changes the operator' fatigue is reduced to a minimum. Yet the powerful drive, together with great rigidity permits multiple cuts, rapid removal of metal and step-up of production.

Due to great versatility this turret lathe is capable of handling an extremely wide range of bar, chucking, and second-operation work.

So, if you are interested in low cost operation write us for further information regarding the features and possibilities of this turret lathe.

BARDONS & OLIVER, INC.
1133 W. 9th STREET • CLEVELAND, OHIO



MORE THREADS • BETTER THREADS • *IN LESS TIME*

LEES-BRADNER
H-T THREAD MILLING MACHINE

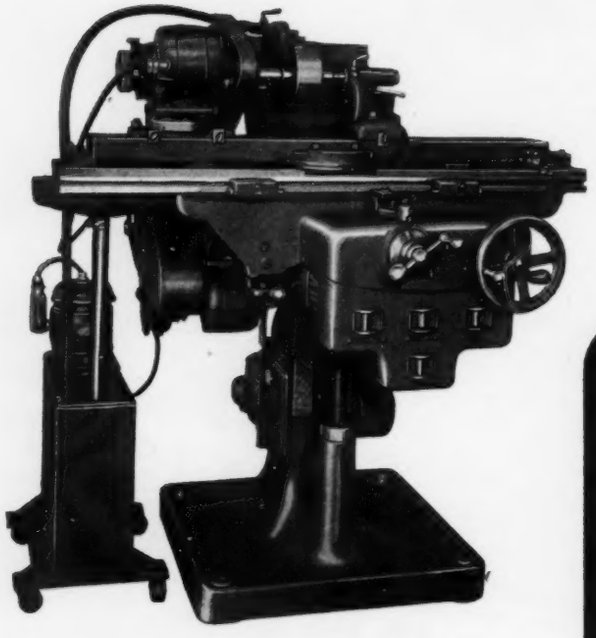
With users reporting savings in time up to 70%—with far superior finishes—your choice should be Lees-Bradner Heavy Type Thread Millers. 12" diameter capacity—in several lengths—for work up to 2½" circular pitch.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

Here's the Answer —

to Your LARGE RADIUS GRINDING Problems



COVEL NO. 91-A

UNIVERSAL CUTTER AND TOOL GRINDER

Operating Convenience Speeds Work

Note location of the electric switches—real unified "fingertip control" of Main Spindle, Head Stock, Power Feed and Wet-Attachment Pump—"91-A" is shown here with motorized Face Mill Grinding Attachment and Wet Grinding Attachment, complete.

Large Radius Grinding Attachment

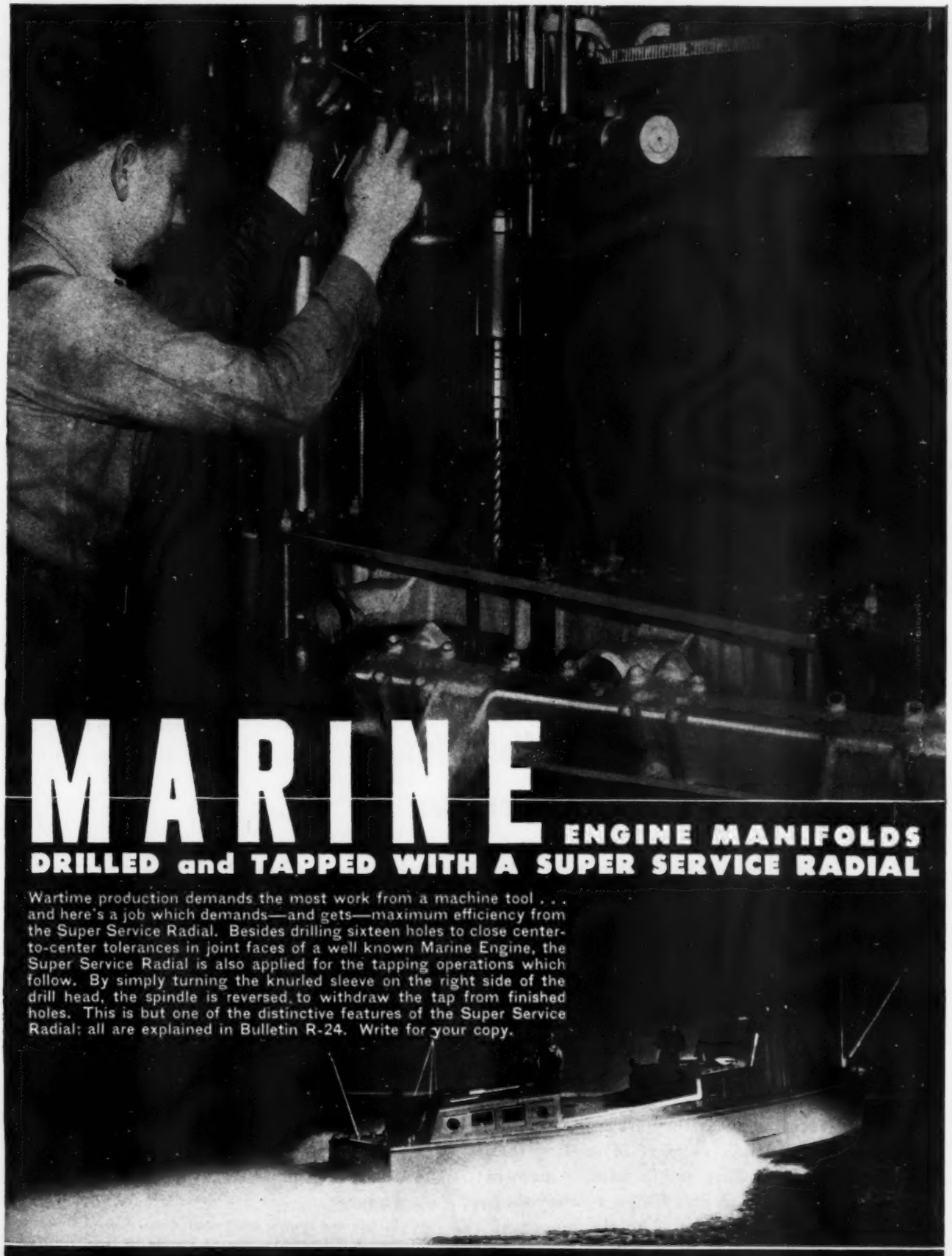
A time-saving unit for grinding radii on various types of work, this Covel Attachment for the 91-A Universal Cutter and Tool Grinder insures longer life to your vital, yet hard-to-get tools and cutters. It is especially adapted to grinding the corner of face milling cutters as shown in this view.

Write, wire or phone for Bulletin A-932 and name of nearest dealer.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.



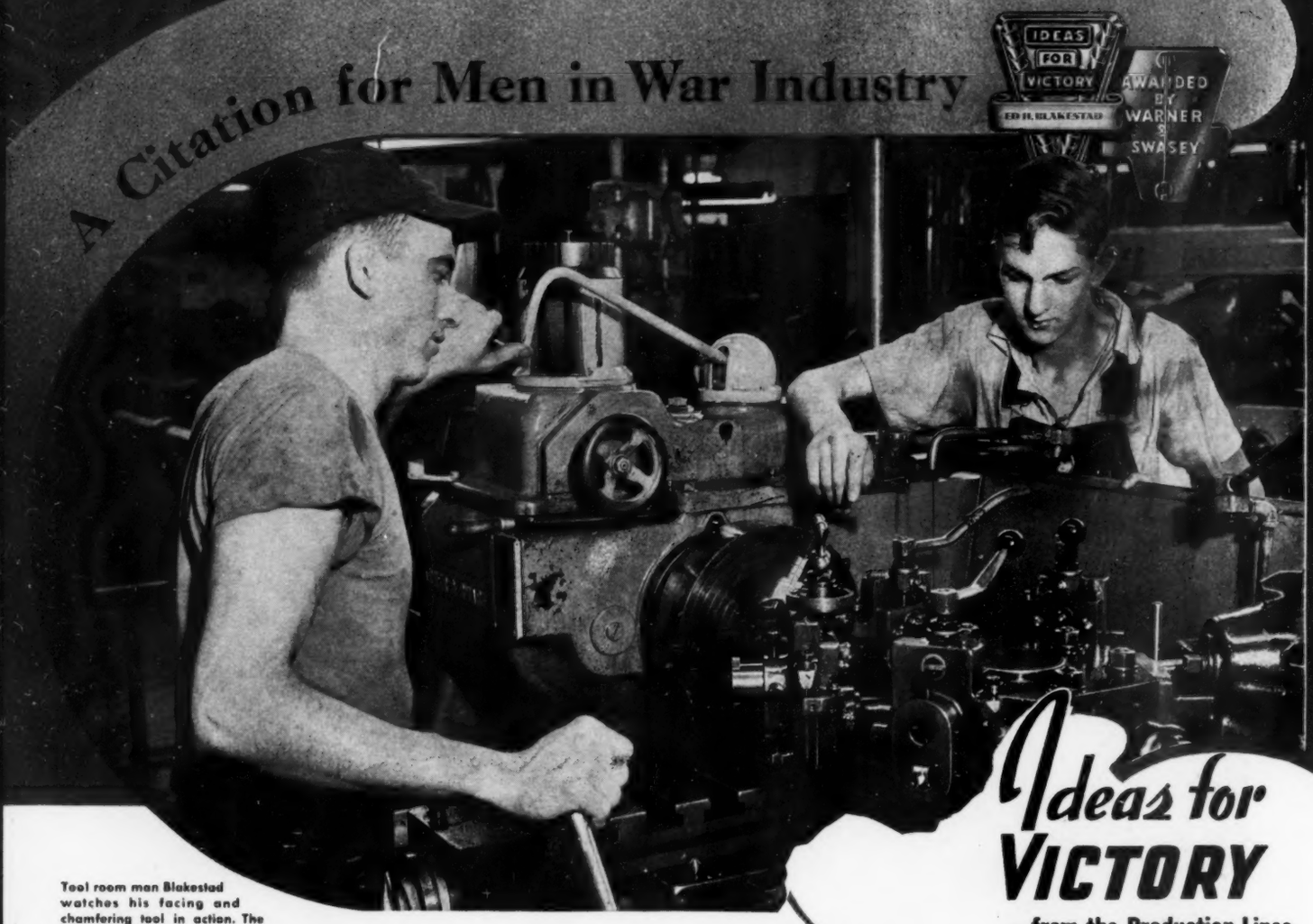
MARINE ENGINE MANIFOLDS
DRILLED and TAPPED WITH A SUPER SERVICE RADIAL

Wartime production demands the most work from a machine tool . . . and here's a job which demands—and gets—maximum efficiency from the Super Service Radial. Besides drilling sixteen holes to close center-to-center tolerances in joint faces of a well known Marine Engine, the Super Service Radial is also applied for the tapping operations which follow. By simply turning the knurled sleeve on the right side of the drill head, the spindle is reversed to withdraw the tap from finished holes. This is but one of the distinctive features of the Super Service Radial: all are explained in Bulletin R-24. Write for your copy.

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

A Citation for Men in War Industry



Tool room man Blakestad watches his facing and chamfering tool in action. The turret lathe operator is S. A. Moore.

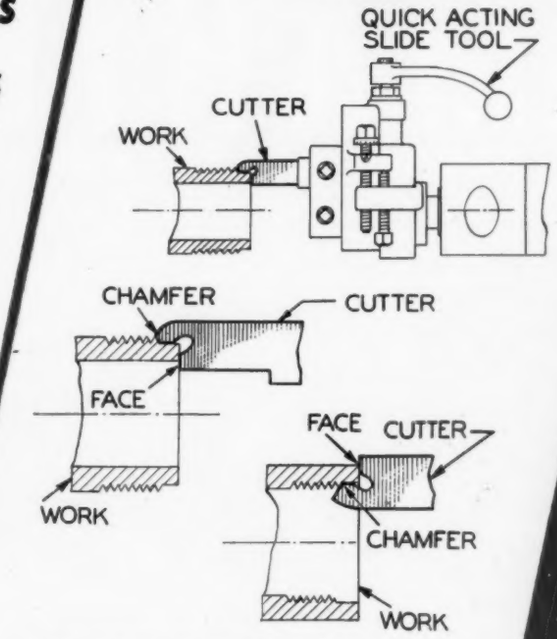
Ideas for VICTORY

—from the Production Lines behind the Firing Lines

A Tool Room Man Offers This Idea to Turret Lathe Operators

Edward H. Blakestad is in the tool room of the Walter O'Bannon Company, Tulsa, Okla. The accompanying sketches explain his idea for grinding a facing and chamfering tool in one, and using it in a quick acting slide tool to save time and make it easier for the operator to face-off tubing and to chamfer for internal or external threads.

The skill and ingenuity of shop men are of inestimable value in this wartime effort. Hundreds of patriotic turret lathe operators are telling us of the successful ideas they are using to speed production. We take pleasure in sending these men gold Victory Pins, and in printing many of their practical ideas in Blue Chips, a newsy shop bulletin which is mailed free to the homes of nearly thirty thousand turret lathe operators. Make sure your learners, apprentices, old-timers and production executives are getting Blue Chips. Write Warner & Swasey, Cleveland, Ohio.



To face and chamfer small tubes. Come down to chamfer O. D. and up to face end. Reverse this operation for I. D. threads. To face and counterbore, bore in and face down on I. D. threads.

YOU CAN TURN IT BETTER, FASTER, FOR LESS
... WITH A WARNER & SWASEY

WARNER & SWASEY FOR VICTORY

WHAT'S IN THIS ISSUE

ERNEST A. MOORE

CAPT. E. G. MOFFAT

L. W. SAGLE

R. P. VALTIER

MANIFOLD FLOW

Ryan Aeronautical supplies a lot of exhaust manifolds to a great many aircraft manufacturers. The war greatly boosted the demand for its products and necessitated a complete revision of its manufacturing methods. How this company's set-up was transformed, from a job shop basis to full production is fully described by Ernest A. Moore, Ryan's factory superintendent. Page 959.

NO RAKE

Captain E. G. Moffat, Watervliet Arsenal, has run some practical experiments on the application of carbides to milling. One thing that he has found out is that negative rate angles step up the speed in machining steel forgings. Captain Moffat illustrates his points with practical examples. Page 935.

SCRAP THE AXIS

The only way to scrap the Axis is by conserving every ounce of material and converting it into planes, guns and tanks. A spread of cartoons in this issue, shows how workers in industrial plants are helping the cause along by doing their bit in conserving materials. This picture story should find its way to many shop bulletin boards. Page 940.

WELDED HEADS

An old bugaboo of railroad maintenance was laid to rest by a new method of joining heads to locomotive cylinders. Brazing cast iron parts and welding those of steel gives a durable result that has effectively stopped leaks. Lawrence W. Sagle, Baltimore & Ohio Railroad, describes the technique. Page 937.

REBUILT MACHINE TOOLS

Reconditioning if done properly produces machine tools comparable in service value to the new product. The Simmons Machine Tool Corporation is an old hand in this business and knows that to do the job right it must be done thoroughly. Its practice is to tear the old machine down completely and rebuild it from the floor up. Page 942.

COFFEE POT

In working sheet metal, successful practice on one product often develops ideas useful on another. Take for instance the common coffee pot. A particular design requires not only deep drawing but closing and marking as well. The tools are described in a well illustrated article. Page 944.

THREE-WAY BURRER

A handy bench tool, now in use at Vultee, is a burring device which has three separate functions. This machine, shown pictorially, is only one of a spread of "Shop Shots" from aircraft plants. Page 950.

DRYING HELMET LINERS

Army helmet liners are made of plastic and have to be dried rapidly after painting without softening the material itself. Radiant heat was at once suggested and proved to be the most effective answer. Page 970.

CHARTING

Fits of various classes require tolerances on the shaft and hole in accordance with the diameter used. The calculations necessary to find the proper combination are greatly simplified by use of a chart prepared by R. P. Valtier. Page 973.

HOT HEADS

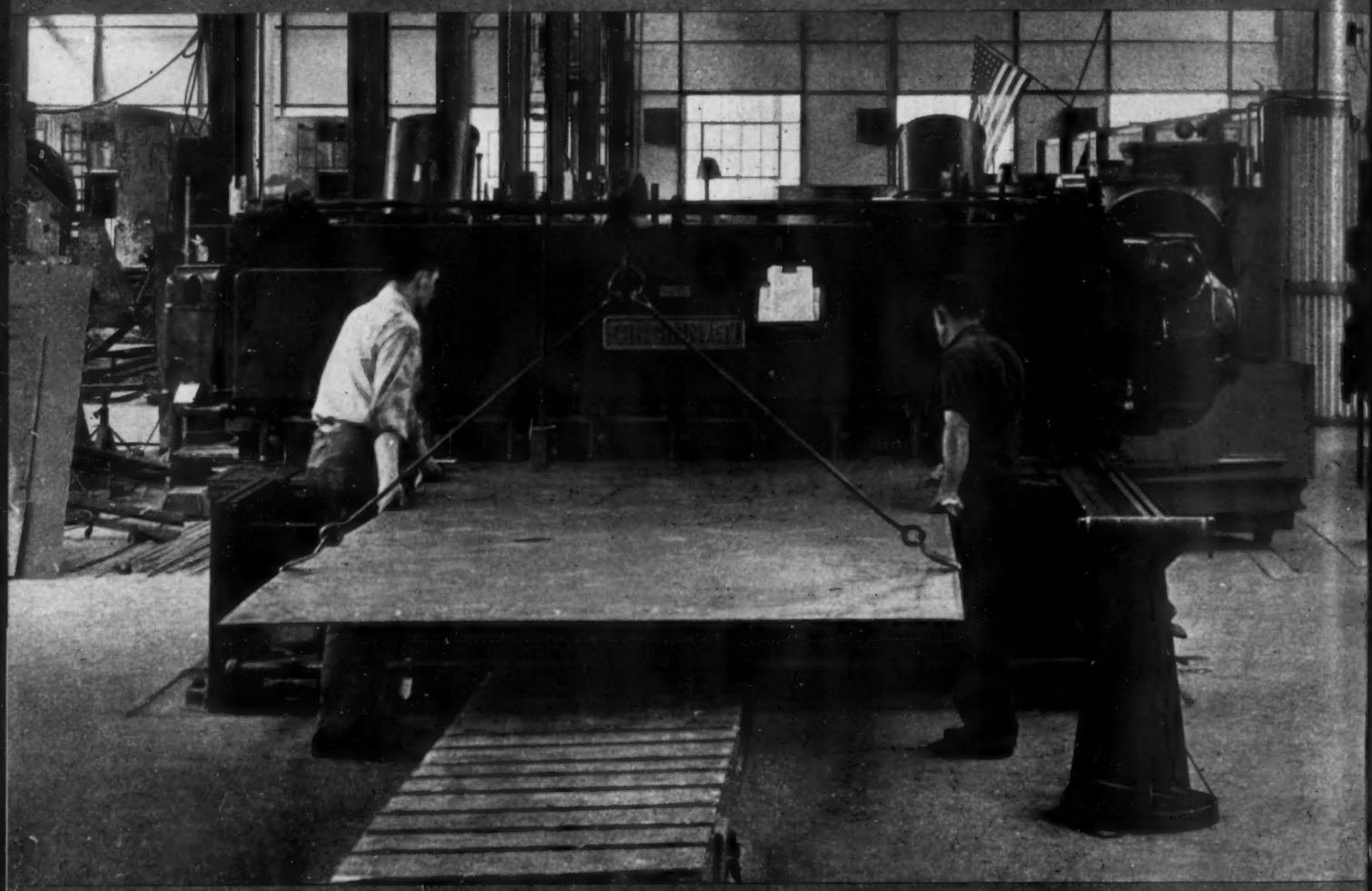
Despite improved technique in cold-heading practice in recent years, the process of forming heads hot still holds its own, especially on short runs where cold-heading die costs would be prohibitive. A practical article on the subject describes the practice used by the Lamson and Sessions Company. Page 952.

COMING

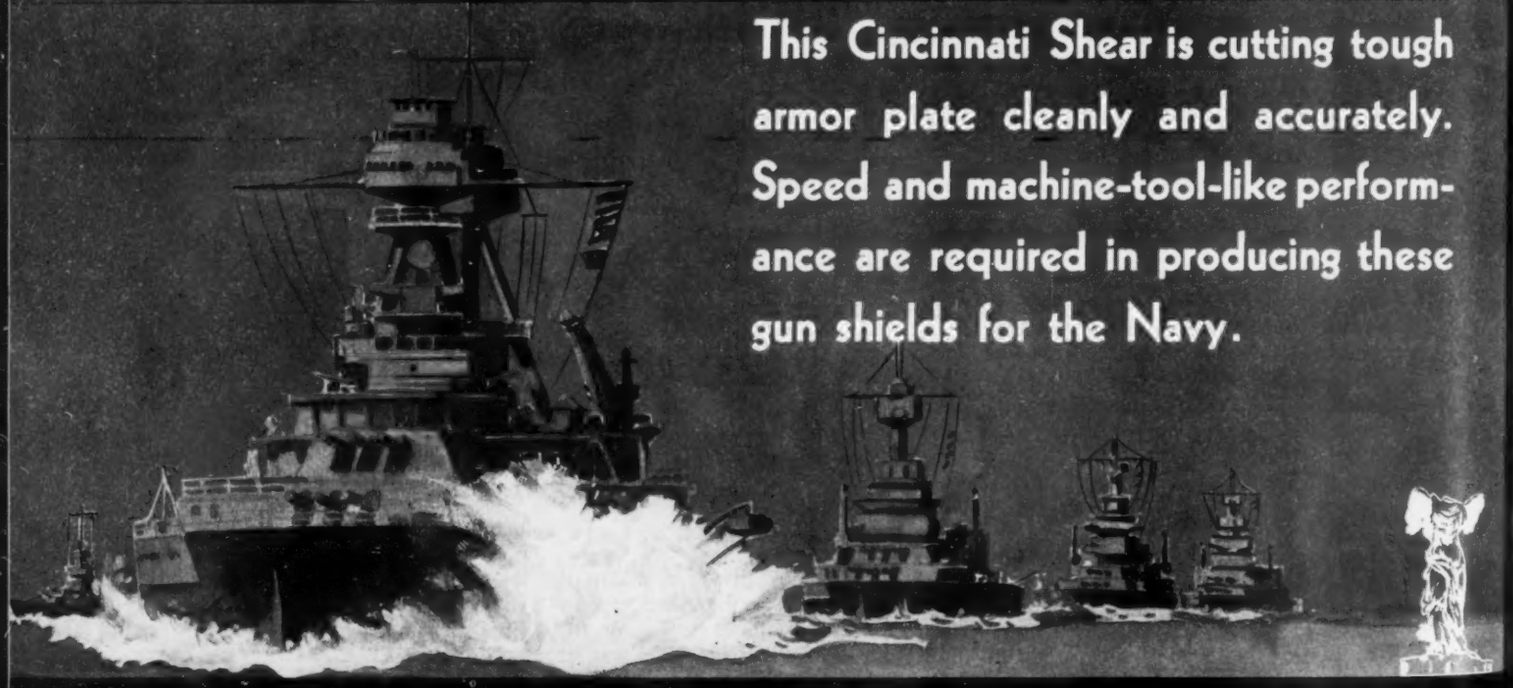
A lot of plants are making gears today that formerly left this job to specialists. Because of the large number of types of gears and the many ways of cutting them, this seems to be a likely time to review the entire subject. A. H. Candee, the Gleason Works, will discuss current practice in gears and gear cutting in an early number. Look for his article soon.

Is your plant protected? How many potential saboteurs are prowling about no one but the FBI knows. However, it is essential to play safe and give your plant the protection it deserves. First requirement is a well drilled police force. The Kearney & Trecker Company has such a force, and an early article will tell how it was organized.

★ GUN SHIELDS FOR THE NAVY



This Cincinnati Shear is cutting tough armor plate cleanly and accurately. Speed and machine-tool-like performance are required in producing these gun shields for the Navy.



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High-Speed Milling With Carbides

BY CAPTAIN E. G. MOFFAT, ORDNANCE DEPARTMENT, WATERVLIET ARSENAL

Tool engineers at Watervliet Arsenal are using cutters with negative rake angles to speed the machining of steel forgings

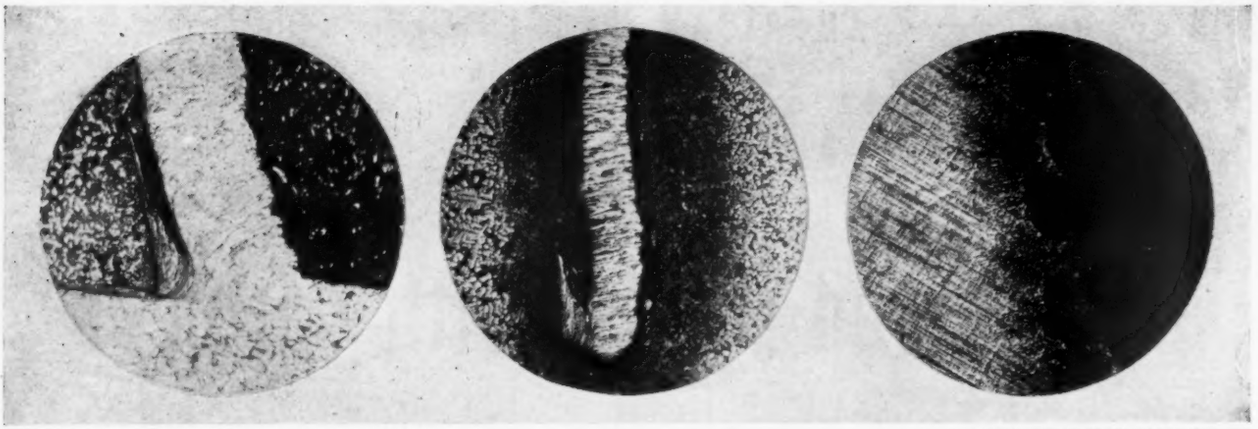
WATERVLIET ARSENAL has developed a method of milling steel with sintered carbides that will mean more weapons in less time than was heretofore thought possible. By taking a new approach to the problem of milling alloy steel parts, the tool engineers and officers of the Arsenal have now made it possible to multiply our production of vital war material. The new method involves a radically different cutter design, a new type of sintered carbide and an exceptionally light feed per tooth per cutter revolution but a high rate of table feed because of extremely high cutting speed.

In milling, as in other steel cutting operations, a virtually stationary mass of steel (known as the built-up edge) continues with both the work piece and the chip, and precedes the advancing cutter tooth, as shown in Fig. 1. Because of the intermittent nature of the milling cut, however, the behavior of the built-up edge is quite different from that formed in steady turning. During the passage of a milling cutter tooth across the surface of the work, the built-up edge is in pressure contact with the tool face. As the tooth leaves the work, the built-up edge is torn from the tool face and usually remains attached to the trailing end of the chip. This action rapidly develops pits in the face of the sintered carbide tip face. Although these pits are normally an appreciable distance back of the cutting edge, they gradually increase in diameter.

The pitting action starts with the first few cuts, and as cutting proceeds the pits on the tooth face rapidly enlarge. Chipping or spalling of the cutting edge occurs when the pitting approaches the cutting edge. Failure of the cutting edge is a direct consequence of the weakening effect of the pitting action, and is not caused by the low shear strength of sintered carbide materials.

Carbide-tipped blades for double negative rake milling cutters should be secured in place with a positive locking device, or brazed in position in the cutter body, to eliminate the danger of the blades loosening

Face mills of the conventional high-speed steel design, as shown in Fig. 2, have not been successful with sintered carbides in the milling of steel. In such cutters both rake and helix add keenness to the cutting edge and facilitate the escape of the chip from the region of the cutting edge. Also, both rake and helix tend to minimize the built-up edge, which is fostered by the resistance offered to chip flow by friction between the underside of the



Courtesy Firth-Sterling Steel Company

Fig. 1—A virtually stationary built-up edge continues with both the work piece and the chip and precedes the advancing cutter tooth when milling steel, as shown in the 100 × microphotograph at the left. During passage of the cutter tooth across the work, the built-up edge is in pressure contact with the tooth face, but as the tooth leaves the work the built up edge is torn from the tooth face and usually remains attached to the trailing end of the chip, as shown in the 30 × microphotograph at the center. At the right is shown a 40 × microphotograph of the cutting edge of a sintered carbide milling cutter blade after the sixth cut across a 187 Brinell test block of SAE 1050 steel composed of two 3¾ in. × 20 in. bars presenting a 7½ in. width to an 8-in. diameter face mill having 16 carbide tipped inserted blades. Depth of cut was 1/16 in., feed was 0.006 in. per tooth per rev. and cutting speed was 225 ft. per min. These pits develop closest to the cutting edge on the face where the chip is thinnest, and are well back of the peripheral cutting edge where the chip is thickest. They ultimately cause a complete breakdown of the cutting edge

chip and the face of the cutting tooth.

Analysis of the nature of sintered carbides and the conditions obtaining when milling steel at the speeds and feeds most favorable to the application of hard carbide-tipped blades has led to the development of a radically different cutter design, like that shown in Fig. 3. In the new cutter, both the rake and the helix angles are negative. At first glance, this seems contrary to all basic metal cutting theory. The use of a negative rake and a negative helix angle tends to trap the chip between the cutting edge and the surface of the work.

Although the negative rake and negative helix angles apparently impede the escape of the chip from the vicinity of the cutting edges, and reduces the keenness of these edges, this design of cutter tooth makes possible the successful milling of steel with sintered carbide. In Fig. 4 is illustrated the weakness of positive rake angles and the strengthening effect of negative rake angles. In the cutter blade having a negative rake angle, the cutting edge angle is actually obtuse, rather than acute as in the conventional design.

A negative rake shears the chip from the work, while the positive rake design digs or plows its way into the work. Positive rake angles force the point of the tooth into the work first, placing all of the strain of penetrating the metal on the weakest part of the tool. Positive rake also tends to pull the tooth into the work, and occasionally the cutter will dig in. Strain is imposed on the machine tool in the wrong direction; the point entering the work first tends to act as a corkscrew, pulling down on the spindle against the end-play adjustment collar rather than directing the strain against the thrust bearing.

Negative rake angles tend to close the pores of the metal being cut, producing a highly burnished surface resembling a ground surface. Moreover, cratering and pitting of the tooth face, as well as wear and chipping of the cutting edge are materially reduced. It is apparent from Fig. 5 that the cutting pressure normal to the cutter axis will have a component normal to the blade and another component parallel to the blade. The latter will tend to dislodge the blade from the body slot.

This tendency for the blade to be pulled out of the cutter will be opposed by the back pressure of the work, but as the tooth leaves the work there is danger of loosening unless some positive method of locking the blade is employed. In the absence of a locking device, the blades can be secured by tack brazing with an oxy-acetylene torch, using Tobin bronze or brazing brass.

High cutting speed entails a high rate of chip formation and chip removal. Consequently, a requisite of carbide milling cutter design is ample chip space in front of each cutting tooth. If an existing cutter body is to be adapted to negative-rake milling by tipping the back of the blades and reversing cutter rotation to provide the double negative rake angles, it is best to remove at least every other tooth to provide needed chip room. It is much better to make a new cutter especially designed for this purpose. Fewer teeth means that thicker, stronger blades with deeper carbide tips can be used with adequate support almost directly beneath each cutting point, minimizing overhang and at the same time affording ample chip space between adjacent teeth.

High-speed carbide milling is carried out with a very light feed per tooth, frequently less than 0.0012 in. per rev. Because of the high cutting speed, however, the rate at which the work passes the cutter (table feed) is often six times the milling feed normally employed with high-speed steel cutters. The light feed fosters a good machined surface finish and causes only a slight temperature rise because deformation is at a minimum with a thin chip. Also, the fine feed rate imposes only light loads on the bearings and other structural members of the machine. There is practically no tendency to chip the cutting edge of the tooth or the edge of fragile work. Distortion of thin sections of the work piece is greatly reduced, both because of the relatively cool cutting action and as a result of the low cutting force.

The minimum cutting speed is

three times the speed used with high-speed steel cutters. Even on heat-treated alloy steel forgings, the speed is in excess of 500 ft. per min. Despite the light feed per tooth per revolution and the relatively coarse pitch of teeth in the cutters, table feeds range up to ten inches per minute.

No Cutting Oils Used

High-speed carbide milling of steel is done dry. No cutting oils or compounds are needed. The thin chip and elevated speed involve a minimum generation of heat, and the chips are moving across the tooth face so rapidly that there is only a scant interval for heat transfer. What little heat is generated is carried away by the chips. It is impossible to detect any temperature rise in massive work and the cutting points of the tool can be touched with the fingertip directly after a cut at 500 ft. per min. or more is completed. There is a stream of sparks which encircles the cutter during operation, but this is due to the carbon in the steel, as in grinding.

Most of the work done so far involves light cuts, seldom exceeding $\frac{1}{16}$ in. depth. Deeper cuts can be taken, particularly if the feed is reduced. Experiments indicate that with thicker blades, deeper tips and tougher grades of carbide, heavy roughing cuts can be taken. The ability of carbide-tipped cutters to cut the hard, abrasive skin of sand castings has materially reduced the amount of stock left on iron castings, such as cylinder blocks. It is probable that a similar reduction of waste will result through the use of negative-rake carbide milling cutters on steel forgings and castings.

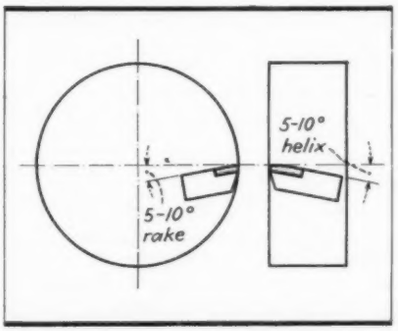
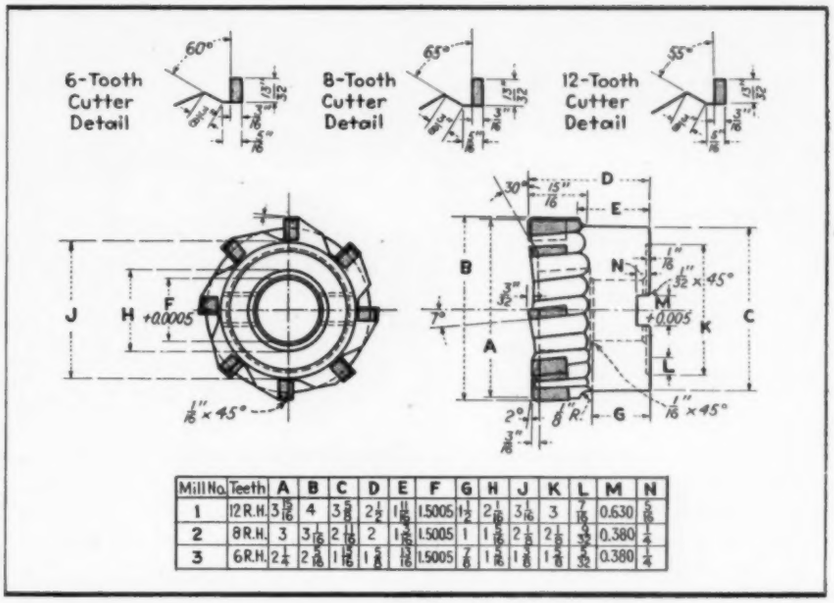


Fig. 2—Conventional high-speed steel face mill designs with positive rake and helix angles ordinarily are not successful when milling steel with sintered carbides. Both rake and helix add keenness to the cutting edge, but this weakens the edge which must carry all of the strain of penetrating the metal



Mill No.	Teeth	A	B	C	D	E	F	G	H	J	K	L	M	N
1	12 R.H.	3 15/16	4	3 5/8	2 1/2	1 11/16	1.5005	1 1/2	2 1/16	3 1/16	3	7/16	0.630	5/16
2	8 R.H.	3	3 1/16	2 11/16	2	1 27/64	1.5005	1	1 1/16	2 1/16	2 1/16	9/32	0.380	1/4
3	6 R.H.	2 1/4	2 5/16	1 13/16	1 5/8	1 27/64	1.5005	7/8	1 1/16	1 1/8	1 1/8	5/32	0.380	1/4

Fig. 3—Negative-angle cutters with carbide-tipped teeth are used at high speeds with fine feeds per tooth per revolution for milling steel. With this design, cratering and pitting of the tooth face, as well as wear and chipping of the cutting edge, are materially reduced. A fine burnished surface is produced on the work

The accompanying tables contrast previous milling practice in the Arsenal with high-speed steel cutters and present usage with sintered carbide. Cutting speeds range up to more than 700 ft. per min., and feeds up to 10 in. per minute are employed. Savings in time or increase in production up to more than 300 percent make the Arsenal's contribution to the War Program one of the notable developments in the present war.

An idea of cutter life to be expected may be gained by considering that cast SAE 4320 modified steel is milled at 487 ft. per min. (228 r.p.m. with an 8-in. cutter) with $\frac{1}{16}$-in. depth of cut and $3\frac{5}{8}$ in. per min. feed, with cutter sharpening only once in 24 hours. The number of cuts necessary to complete the milling of a forged steel breechblock has been reduced from 43 with high-speed steel cutters to 14 with carbide cutters. Cutting speed on this part was increased from 53 to 455 ft. per min.—almost tenfold. Also, cutting time has been reduced from 24 to 6 hours.

An interesting application of negative-rake carbide milling cutters has been in connection with the machining of some hard cast bearing bronze strips that could not be milled with high-speed steel cutters because the heat generated warped the thin material, destroying the accuracy and usefulness of the strips. Using an 8-in. inserted-tooth milling cutter at 185 r.p.m. in a Cincinnati planer-type miller with a feed of 7 in. per min., and roughing with a 0.050 in. depth of cut and then finishing with a 0.010 in. depth of cut, the cutting time per strip was two hours, and the average production per tool grind was two strips—with 60 cu. in. of stock removed per tool grind.

Honing Improves Tool Life

When grinding negative-rake carbide cutters for milling, a 45-deg. corner chamfer is used—although there is no serious objection to a corner radius if the cutter must produce a fillet in cutting to a shoulder. The face of the tooth has a flat which is parallel to the machined surface. The smoothness of this flat cutting edge determines the quality of the machined surface to a great extent. After grinding with a fine-grit silicon carbide vitreous bond or diamond-impregnated resinoid bond wheel, all cutting edges should be carefully lapped or stoned with a silicon carbide or diamond-impregnated hand hone to remove all traces of a saw-tooth or ragged edge. This stoning adds greatly to the life of the cutter between grinds.

Cutting edges have a 3-deg. relief, and since the appearance of a properly relieved cutting tooth with negative rake is deceiving to inexperienced grinding room personnel, it is best to use a dial indicator on each tooth. The end cutting edge angle starts at least $\frac{1}{16}$ in. inside the carbide tip width, and varies from 5 to 10 deg.

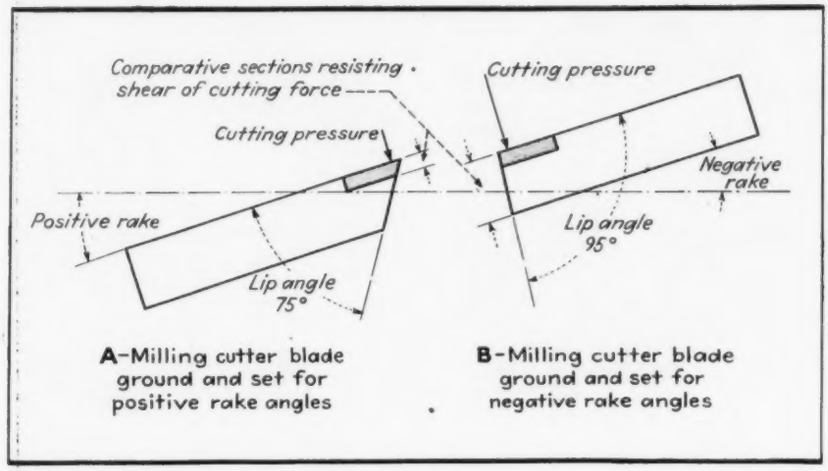

Comparative sections resisting shear of cutting force
Cutting pressure
Cutting pressure
Negative rake
Positive rake
Lip angle 95°
Lip angle 75°
A-Milling cutter blade ground and set for positive rake angles
B-Milling cutter blade ground and set for negative rake angles

Fig. 4—A comparison of the strength of cutter blades ground and set for positive and negative rakes shows one of the advantages of the latter. The blade with negative rake shears the metal off the work, while the one with positive rake digs or plows its way into the work with its weakest section

For best results and highest quality finish, the heel of the cutting tooth must be cleared sufficiently to preclude any possibility of dragging.

While it is true that the negative angles force the chip to climb a "two-way" hill, the chip is given a "head start" and a terrific boost by the high cutting speed employed. With positive rake, the escape of the chip from the region of the tool point is facilitated by the chip sliding downhill. With negative rake, the chip is pressed tightly against the uncut surface of the work and considerable thrust is developed, tending to separate the tooth and the work—yet the chips are compactly formed without the appearance of excessive compression or upsetting.

The underside of the chip is remarkably smooth and the edge is free of the jagged points which characterize chips produced with high-speed steel cutters at much slower speeds and coarser feeds. Likewise, the inner surface of the chip is velvety smooth rather than deeply serrated. Chip formation at slow speeds is accompanied by severe deformation, producing a tear type chip. At high speeds, a flow type chip is formed.

By increasing cutting speed, we are in effect increasing the rate of loading or compression and shear of the metal forming the chip. The plasticity of the metal of the chip increases so rapidly that flow occurs which is not greatly different from that of a fluid rather than a solid. In this light, the built-up edge can be likened to the almost stationary fluid film found near the walls of a conduit through which a fluid is passing. The higher the velocity, the thinner the film—the same condition exists in the case of the built-up edge.

It has always been customary to measure the efficiency of metal removal by computing the cubic inches removed per horsepower per minute. On this basis, thick chips are more efficiently removed than thin chips. This belief has decreed deep cuts, slow speeds and heavy feeds. Today the emphasis is not so much on economy from a cost-of-power standpoint as it is a matter of maximum rate of production. Fine feeds and high speeds as used with sintered carbides will do more work and remove more metal in less time than high-speed steel cutters at conventional speeds and feeds.

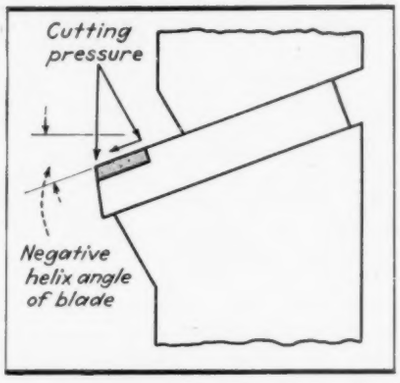


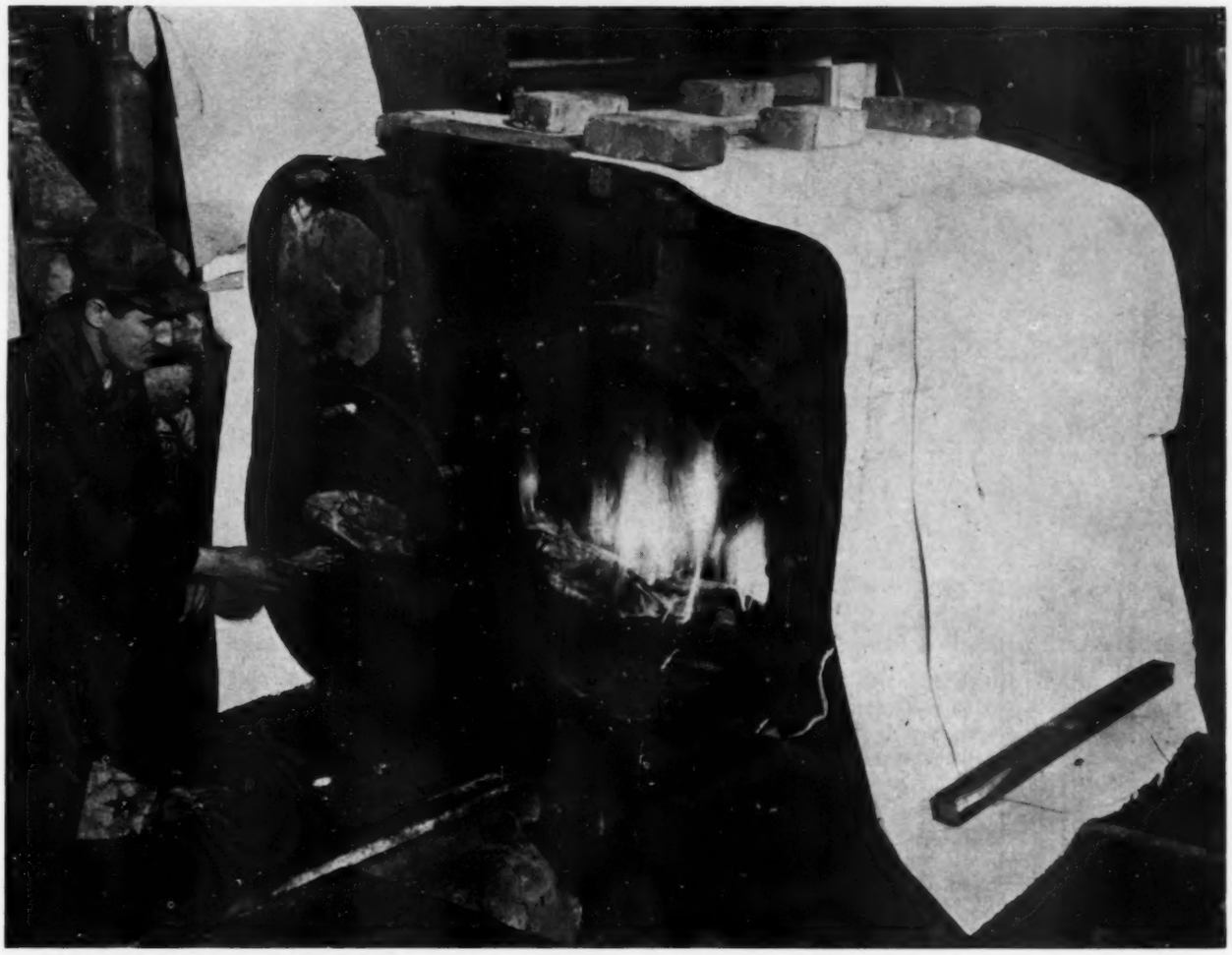
Fig. 5—With carbide-tipped milling cutter blades ground and set for negative rake and helix angles, the cutting pressure normal to the cutter axis will have a component normal to the blade and another component parallel to the blade. The second component tends to dislodge the blade from the body slot, but is opposed by the back pressure of the work. This back pressure is released suddenly as the tooth leaves the work and there is danger of loosening the blade unless some positive locking method, such as brazing, is employed

MATERIAL — Cast-steel reamer body
BRINELL — 240–280
OPERATION — Rough mill width to size
DEPTH OF CUT — ⅛ in.
NUMBER OF CUTS — Four
MACHINE — Cincinnati No. 5 vertical miller

Type of cutting material	High-speed Steel	Carbide
Average bodies per tool grind	2	8
Stock removed per tool grind, cu. in.	82	328
Spindle speed, r. p. m.	63	450
Surface speed, ft. per min.	100	705
Feed, in. per min.	2⅛	7⅜
Cutting time per reamer body, minutes	44	12
Diameter of face mill, inches	6	6

MATERIAL — Forged-steel breech ring
OPERATION — Rough mill face
DEPTH OF CUT — 100 in.
NUMBER OF CUTS — Three
MACHINE — Cincinnati No. 4 vertical miller

Type of cutting material	High-speed Steel	Carbide
Average rings per tool grind	12	18
Stock removed per tool grind, cu. in.	108	162
Spindle speed, r. p. m.	110	286
Surface speed, ft. per min.	115	300
Feed, in. per min.	1/20	4¼
Cutting time per ring, hours	4	1
Diameter of inserted-tooth face mill, inches	4	4



A slow charcoal fire is kindled in the cylinder and allowed to heat for from four to five hours to expand the cylinder before welding. After welding is completed, the covering is not removed until the cylinder is cold

Locomotive Cylinder Heads Welded

BY LAWRENCE W. SAGLE, BALTIMORE & OHIO RAILROAD

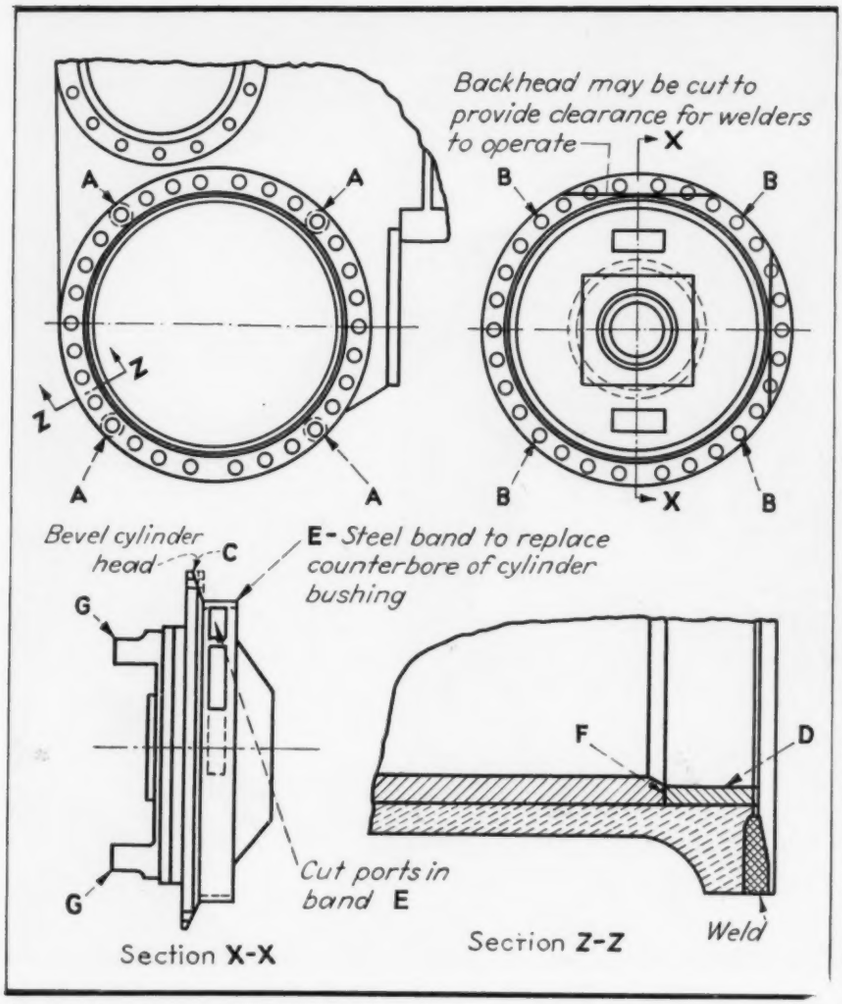
The method here described has become standard practice with some roads to stop steam leaks around the back cylinder heads

VIBRATION from crossheads and guides on locomotives set up stresses and strains in the back cylinder heads causing them to leak steam. This has been eliminated in locomotives of recent design which have cylinders, including the backheads, cast integrally with the frames. The success of these integral castings raised the question of brazing the cast-steel heads to the cast-iron cylinders of older locomotives.

Brazing the heads to the cylinders presents little difficulty, because the coefficients of expansion of the two metals under high heat do not vary greatly —the difference in linear expansion is but 0.00000018 in., while that of cubic expansion is 0.00000052 in. The job was tried on several railroads and after passing through an experimental stage has been adopted as standard practice. One recommended procedure for welding the backheads in place is as follows:

Remove the backhead and cut all but four studs off flush with the face of the cylinder casting, leaving studs *A* to be used to hold the head in place for brazing. All but four holes *B* in the back head are plugged and welded electrically. The inside of the head flange is then beveled at *C* to provide added space for the weld.

The next step is to prepare the cylinder for the permanent head. A boring bar is set up and the counterbore *D* of the cylinder bushing is removed. A steel band *E* with ports cut therein to



Some railroads are welding back cylinder heads in place to prevent steam leaks. The counterbore is machined from the cylinder bushing, and is replaced by a steel band welded to the cylinder head. This band butts against the cylinder bushing when the head is welded permanently

COST OF WELDING TWO CYLINDER HEADS

Labor cost:		
Setting up boring bar and removing back counterbores		$5.95
Cutting off back cylinder-head studs		0.45
Making plugs for cylinder-head holes		1.28
Welding holes in cylinder heads and welding bands for counterbores		5.40
Rolling bands for back cylinder heads		0.85
Setting up and machining cylinder heads and bands		10.20
Grinding cylinder faces for brazing and putting on cylinder heads		3.40
Brazing back cylinder heads to cylinders		34.65
Total labor cost		$62.18
Material cost:		
Bronze	$26.16	
Oxygen and acetylene	25.08	
Flux	0.45	
Asbestos paper	4.90	
Charketts	8.12	
Total material cost		64.71
Total for welding two cylinder heads		$126.89

replace the holes in the cylinder bushing, is welded to the cylinder head and machined for the cylinder fit. This arrangement makes a permanent steel counterbore, and it is only necessary to butt the end of the cylinder bushing to the steel band at *F* when the bushing is to be renewed. No cutting of ports in the rear of the bushing is necessary.

The cylinder head is then set in place, and the guide blocks or brackets *G* lined up with the top of the frames, after which the head is clamped in place with nuts on the four studs *B*.

Cost Is $63.45 Per Head

The cylinder and head and then preheated in the same manner as for brazing a break in the cylinder. Manganese bronze rod and a good flux is used in the welding operation. Brazing should be started at the bottom of the head and cylinder, and carried up both sides and across the top by two operators working simultaneously—some roads recommend brazing from top to bottom on one side of the head and from bottom to top on the other side. The clamping studs should be cut off flush with the cylinder face as the weld proceeds. When brazing is completed, the entire heated section of the head and cylinder should be covered and allowed to cool slowly.

The cost of brazing two cast steel cylinder heads of 30-in. diameter is shown in the table. The total cost of $126.89 for brazing the heads is a fair figure and gives a factor of $2.115 per diameter inch for cost estimating purposes. Thus, one cylinder head of 30-in. outside diameter would cost $2.115 × 30 = $63.45 per head. This covers cost of labor, material but not overhead, as overhead is included here with the labor and material costs.

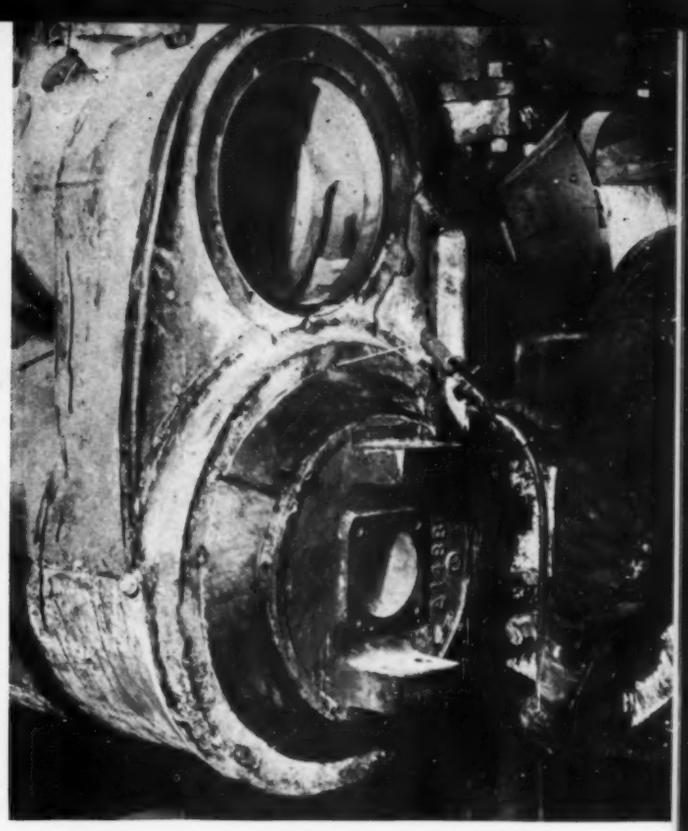
Another method advocated for brazing heads to cylinders is to leave all the cylinder studs in the cylinder, cut off the cylinder nuts flush with the outside of the cylinder head, electric weld the studs to the head, and then braze. However, some roads believe that this procedure is not necessary, since a good brazed joint with the cylinder studs removed gives excellent results.

Welding Cast-steel Cylinders

For welding cast-steel cylinder heads to cast-steel cylinders, two different types of joints are used. One is for the permanent application of the head, which is prepared similar to the procedure for brazing the heads to cast-iron cylinders, eliminating the pre-heating furnace, and is electric welded. However, some pre-heating may be used.

The other type of joint is a temporary one. The procedure is to apply the cylinder head in the conventional way

Four to six studs can be left in place to pull the cylinder head up tight preparatory to welding. The remaining studs are cut off flush with the cylinder, while the holes in the head are plugged and welded



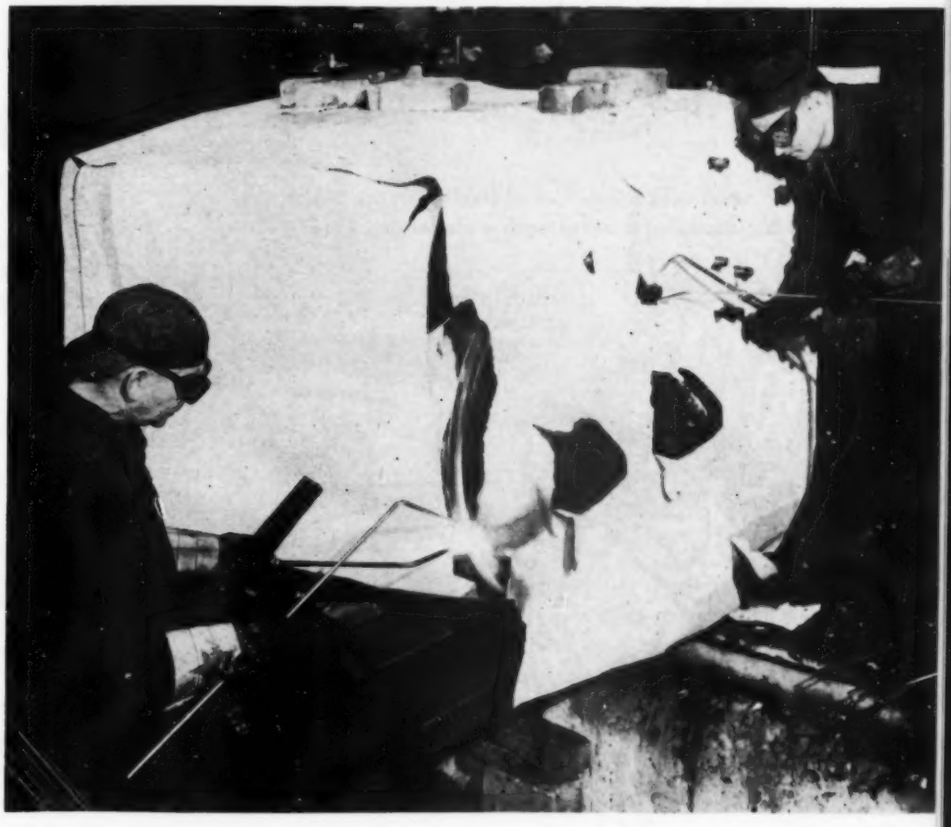
The final operation on this job is to weld a shield over the asbestos filled cavity between cylinder and cylinder head. This procedure permanently stopped steam leaks around the back head

with all cylinder studs in place and the head drawn up tight. A protective covering of $\frac{3}{8}$-in. steel rod is used on the outside of the cylinder studs for the full circumference of the head, between the head and the cylinder, and is electric welded, connecting the surface of the cast steel head and cylinder. A bead of electric weld is also run around each cylinder stud nut. This type of weld is supposed to stop steam leaks and designed so that the weld may be removed by gouging. The studs that were protected from being welded by the $\frac{3}{8}$-in. rod covering may then be removed and renewed, and the welding procedure again followed.

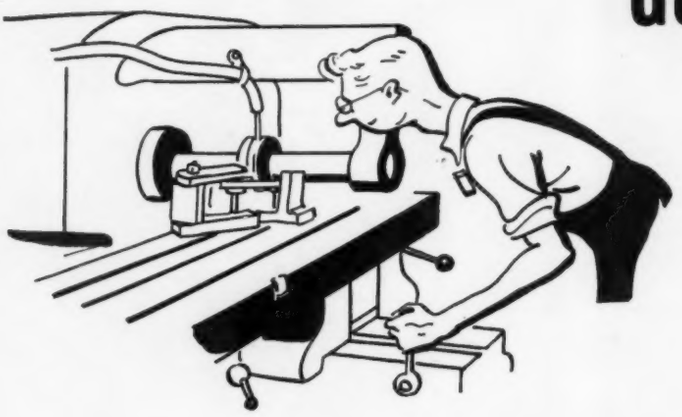
The cost of brazing cylinder heads to locomotive cylinders is very little higher, if any, than the cost of the grinding method. The latter method involves removing the main rod, crosshead, guides, the cylinder head, piston and all back cylinder-head studs. The joints are ground and all parts reassembled. This method does not give a permanent leak-proof joint, whereas the brazing method herein described insures a permanent steam-tight job around the back cylinder heads.

The illustrations accompanying this article were furnished by the Baltimore & Ohio Railroad, which has successfully welded back cylinder heads on a number of its heavy Santa Fe and Mallett freight locomotives at the locomotive shop in Cumberland, Md.

Two welders should work simultaneously while brazing the cylinder head. Some railroads recommend that the weld be started at the bottom and carried up both sides and across the top. On other roads, one welder starts at the top and works to the bottom, while the other starts at the bottom and works towards the top



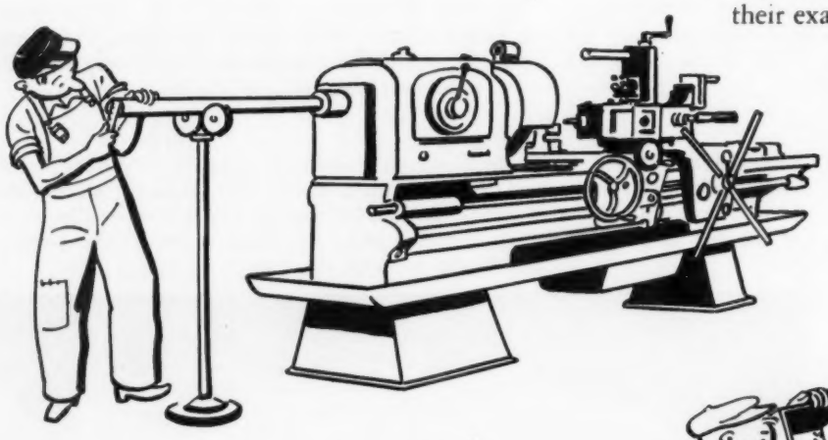
Get in That Scrap



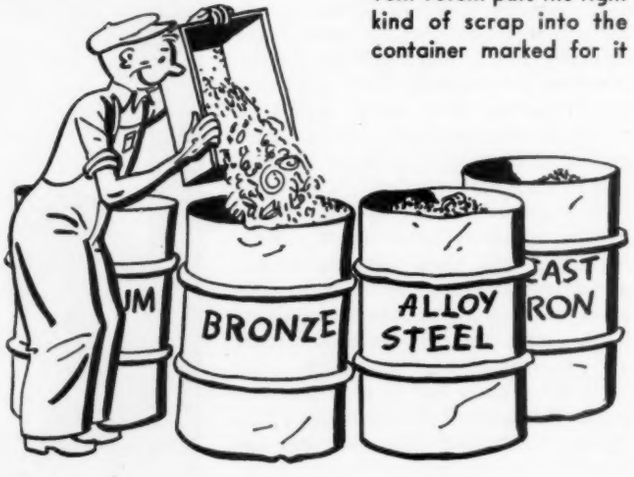
Clarence Miller is careful not to spoil any work; he saves scrap by refusing to create more than necessary

WAR ONCE DEPENDED solely on armed masses of men at the front. Today the masses are needed at machines behind the lines, producing planes and tanks and guns.

It is a war of materials as well as a war of men. All metal-working plants have an enormous byproduct in scrap. A year ago much of this material was wasted; now it is vital that every possible ounce be saved. Everyone in the plant, from the president to the sweeper, can do his part. Shown on these pages are some of the boys who are getting in that scrap. If everyone follows their example the scrap will be won.



Bill Billet never uses a 3-in. bar of steel when the 2¾ size is big enough. He saves both material and time



Tom Totem puts the right kind of scrap into the container marked for it

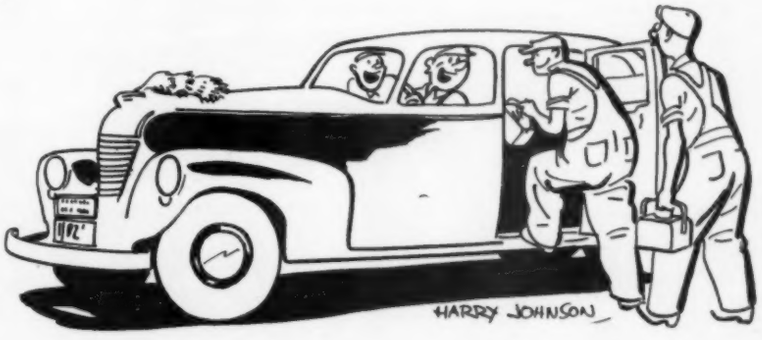
Eddy Broome cleans his machine every time he changes to a new material. He knows that bronze loses its value when mixed with cast iron

Steve Stanley discovers a good many usable tools by looking under benches and in unused cupboards

Ray Hope doesn't thoughtlessly discard parts that do not quite meet specifications. He tries to figure out some way of saving them

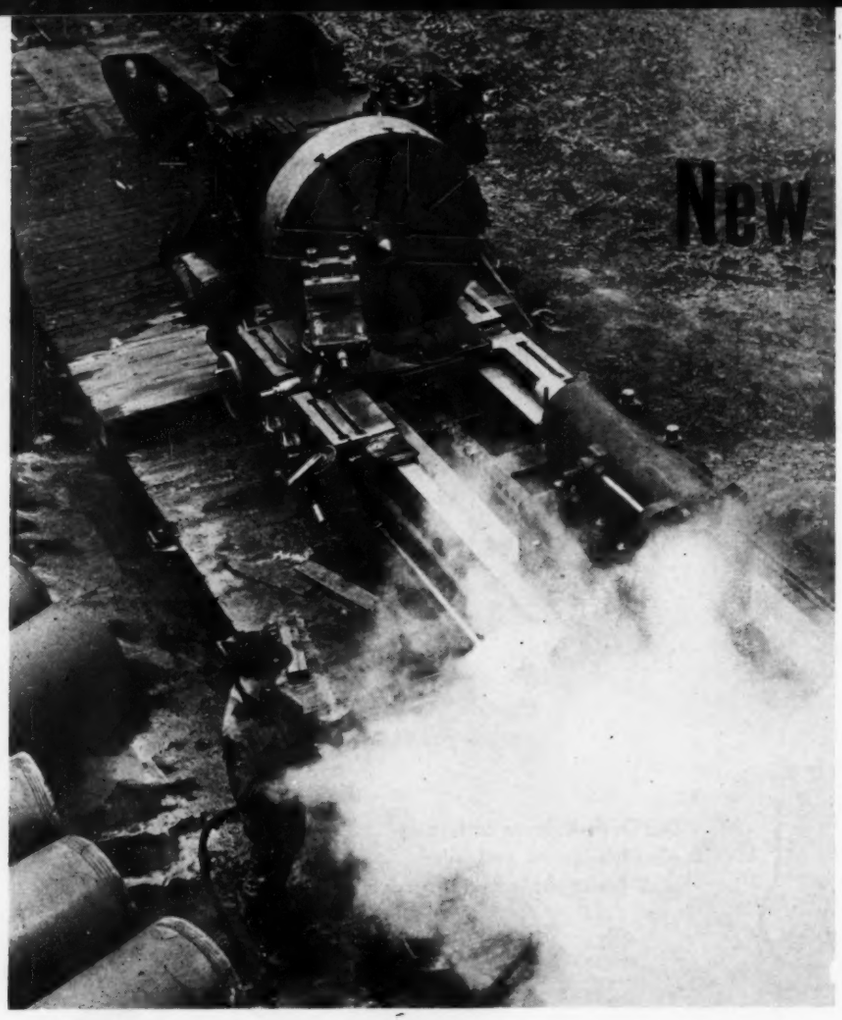
Sam Salvage dismantles obsolete equipment, saves the needed parts and sorts out the rest for scrap

Ted Thrift reclaims cutting oils, lubricants and surplus paint of all kinds



Phil Carr saves gas and tires by carrying three shopmates with him when he drives to the plant

Harry Hawke watches all the refuse and sweepings that leave the shop to prevent waste of usable metals



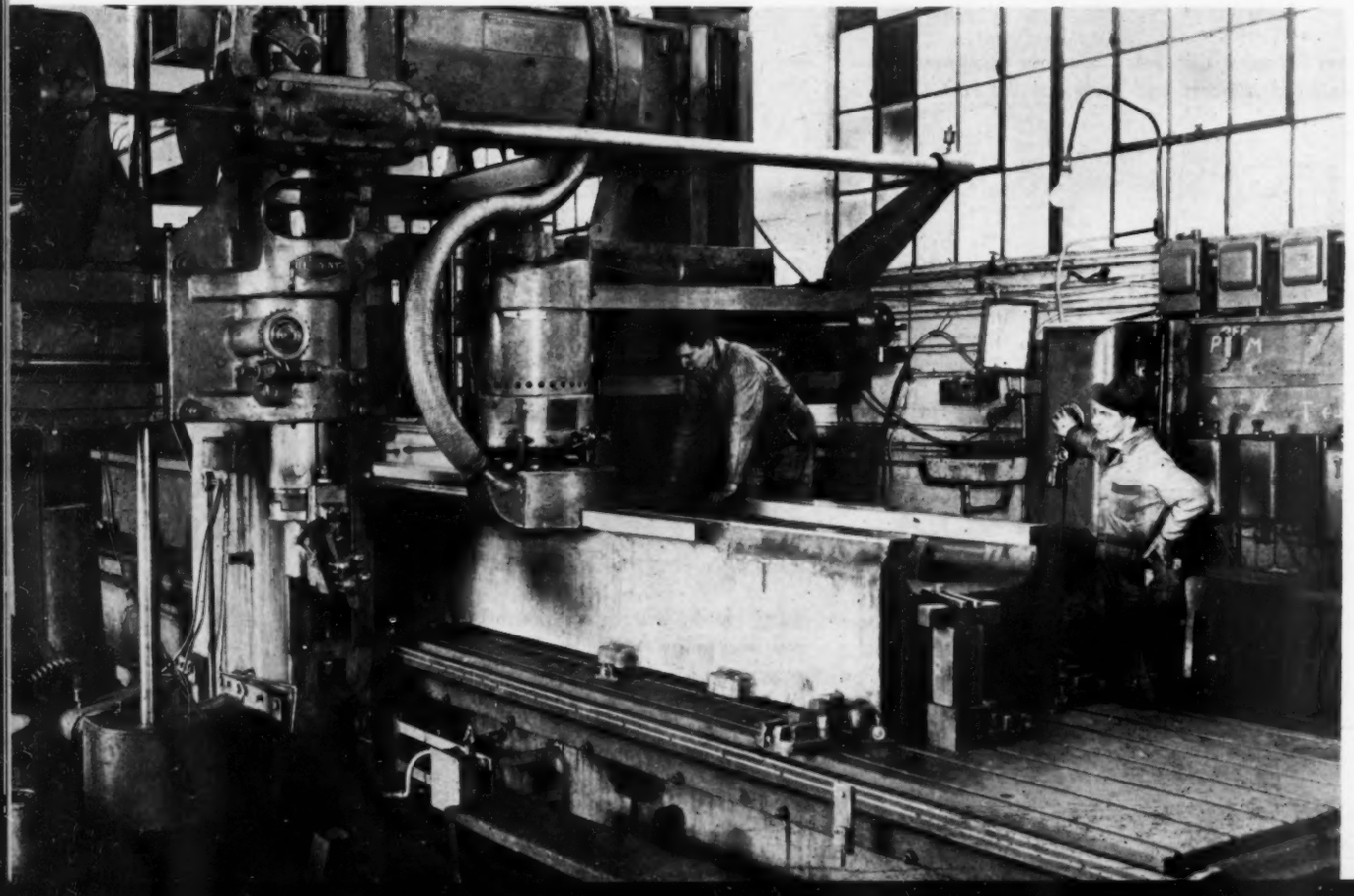
New Machines From Old

RECONDITIONING machine tools means a complete teardown, replacement of worn or broken parts and rebuilding with the care that went into them originally. Reputable concerns now reconditioning machine tools have built their reputations on their ability to do a first-class job.

At the plant of the Simmons Machine Tool Corporation, for example,

Old machines being brought in for rebuilding are given a "turkish bath" before they enter the shop. Steam supplied at 100 lb. pressure removes most of the grease and dirt deposited on the machine's surfaces during years of use. Next, each machine is inspected carefully, and is stripped of all removable parts

Beds and tables go to a large Bement planer where the ways and other surfaces are planed or milled and then surface ground. Meanwhile gears, shafts, bearing bushings, and other small parts are being repaired or replaced in the machine shop. This 75 × 48-in. planer is of particular interest, since the left-hand head can be used either for milling or planing, and the right-hand head has been fitted with a 25 hp. Blanchard surface grinder spindle which can be swiveled to any angle to grind the sides of V-ways on beds, tables and carriages. Way surfaces are rough ground at 10 ft. per min. and finished at 5 ft. per minute

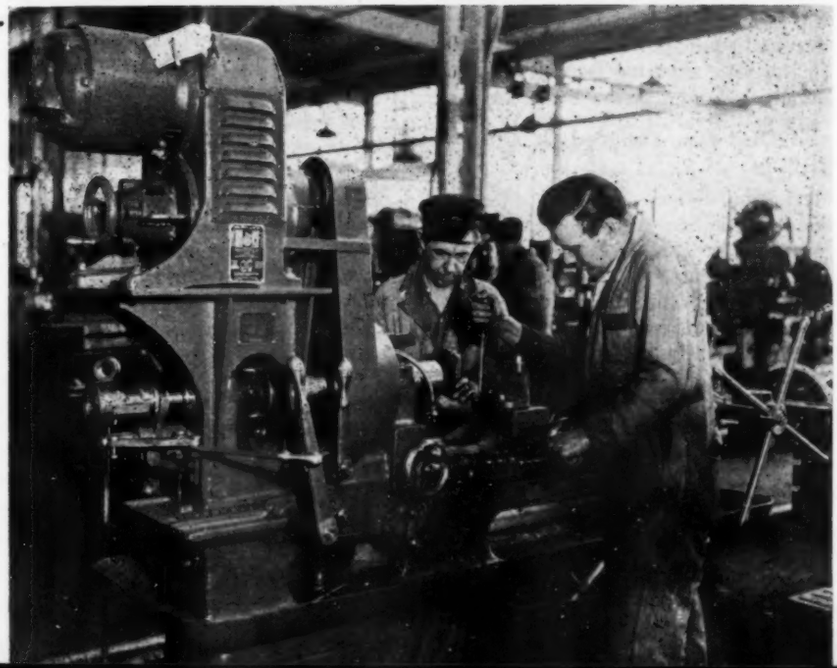


machine tools of every conceivable type, make and size—some obsolete and in need of modernization, some just worn out because of intensive use and some badly damaged—are thoroughly rebuilt and modernized to meet the requirements of today's metal-working operations. First, each machine is gone over carefully to determine what must be done to put it in satisfactory working order. Then it is thoroughly cleaned, dismantled and the parts that need adjustment or replacement are sent to the machine shop.

During the "regeneration of the machine," bushings, gears and other worn parts are replaced, beds are lined up and the ways are planed or milled and then ground to provide an accurate bearing surface. In addition to straight rebuilding, many machines are modernized by providing individual motor drives in place of old belt drives.

The Blanchard grinding head fitted in place of the usual tool head on the large Bement planer can be swiveled to any desired angle so as to finish V-ways on beds, tables and carriages. This head has independent controls, and operates at 880 r.p.m. A variable speed 16-hp. motor drives the 6 × 40-ft. planer table at slow speeds during grinding operation

Where shafts or spindles are worn too small to be refinished and still have sufficient diameter, they are built up by welding in a special lathe developed by Simmons engineers. This machine is a standard lathe, with a variable-speed drive to the main spindle and a stripped carriage on which is mounted the automatic welding head that feeds coated wire electrode from an overhead reel. Current for welding is furnished by a 300-amp. G.E. direct current set, welding usually being done at 12 volts and 120 amp. with the carriage traversed at about 1/4 in. per rev. Sometimes shafts are built up 2 or 3 in. on the diameter by welding several passes



As work is completed on repaired and replacement parts, the machines are reassembled by skilled mechanics. Frequently, belt-driven machines are modernized by mounting infinitely variable-speed drives on welded brackets mounted above or beside the headstock. When assembly has been completed, each machine is carefully inspected

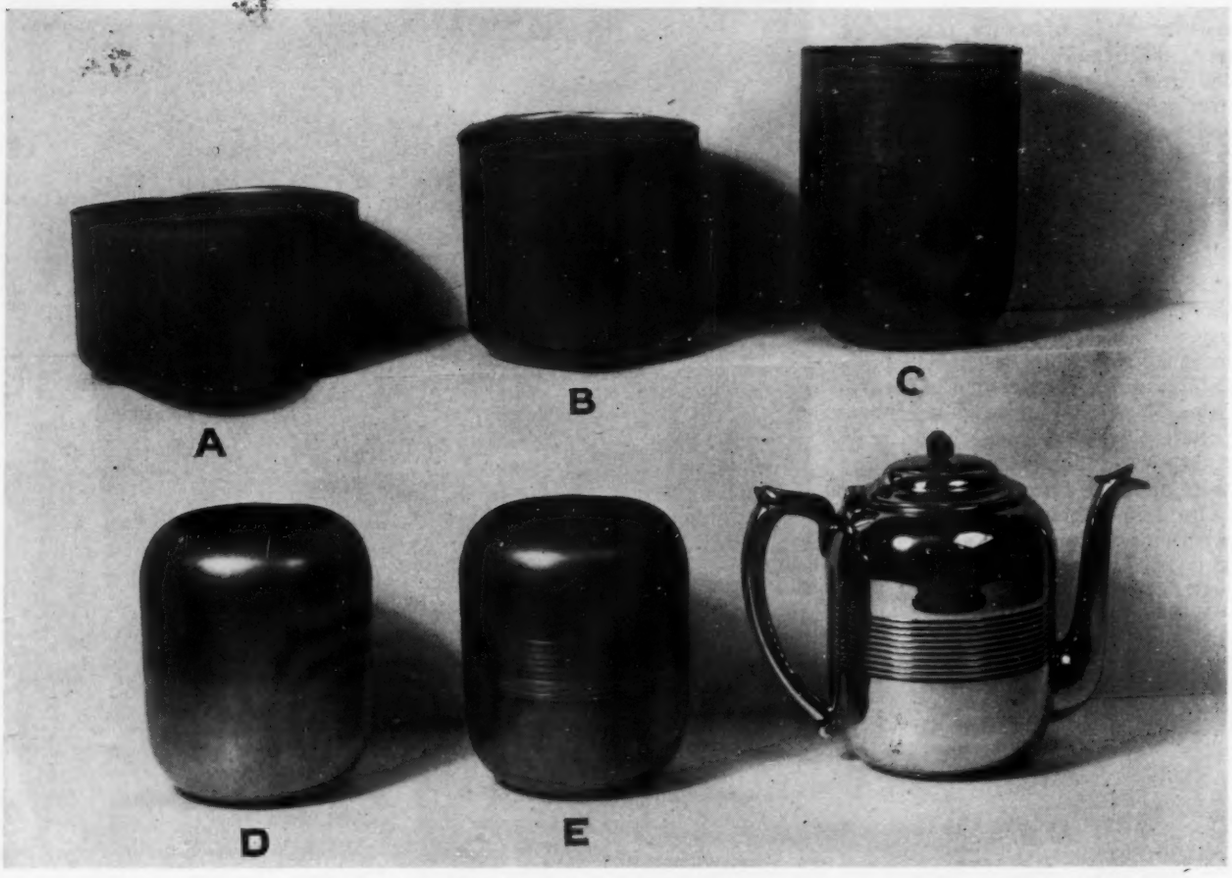


Fig. 1—Step by step, the shell takes form in the manufacture of a common household object

Press Work on Hollow Parts

BY MARK GOLDEN

Closing and marking require ingenious tools in addition to those designed for deep drawing

THE SHELL shown at *E*, Fig. 1, involves deep drawing and in addition the difficult operation of closing the end. It is drawn from a 10½-in. blank of 20-gage (0.032 in.) deep-drawing copper.

The first operation die is shown in Fig. 2. Both die and blank holder have hardened and ground tool steel rings with forced fits in cast iron shoes.

The die ring has a ¼-in. fillet. Three pins are used to locate the blank concentrically with the die opening. The punch is made of cold-rolled steel with a standard 1⅜-in.—8 thread for attaching it to the inner rim of the draw press. The angle on the lower end of the punch is 45 deg., and the corners are well rounded. The shell as drawn in the first operation is 6 in. in diameter and 3½ in. deep and is shown at *A*.

Diameter Reduced in Die

In the next operation the shell is reduced in diameter and increased in length; the die used is shown in Fig. 3. The cast iron die shoe holds the tool-steel ring, having a 45-deg. angle which corresponds with the angle on the shell as drawn in the first operation die. The corner of the ring, where the angle meets the straight part of the opening, is rounded to a radius of about $\frac{5}{16}$ in. The blank holder has a machine-steel back, while the cylindrical part that does the actual work is tool steel, also with a 45-deg. angle and well rounded corners.

Both die ring and blank holder are, of course, hardened and ground and are highly polished to prevent scratching or tearing the shell. The punch is cold-rolled steel threaded for attachment to the press, and as is the case with all punches for this type of work, has a vent to the outer air. Otherwise air compression would break the shells or cause trouble in stripping them from the punch.

The shell in this operation is reduced to 5⅛ in. in diameter and has been increased to 4½ in. in height. The shell is shown at *B*.

The third operation die is shown in Fig. 4. The construction of this die is

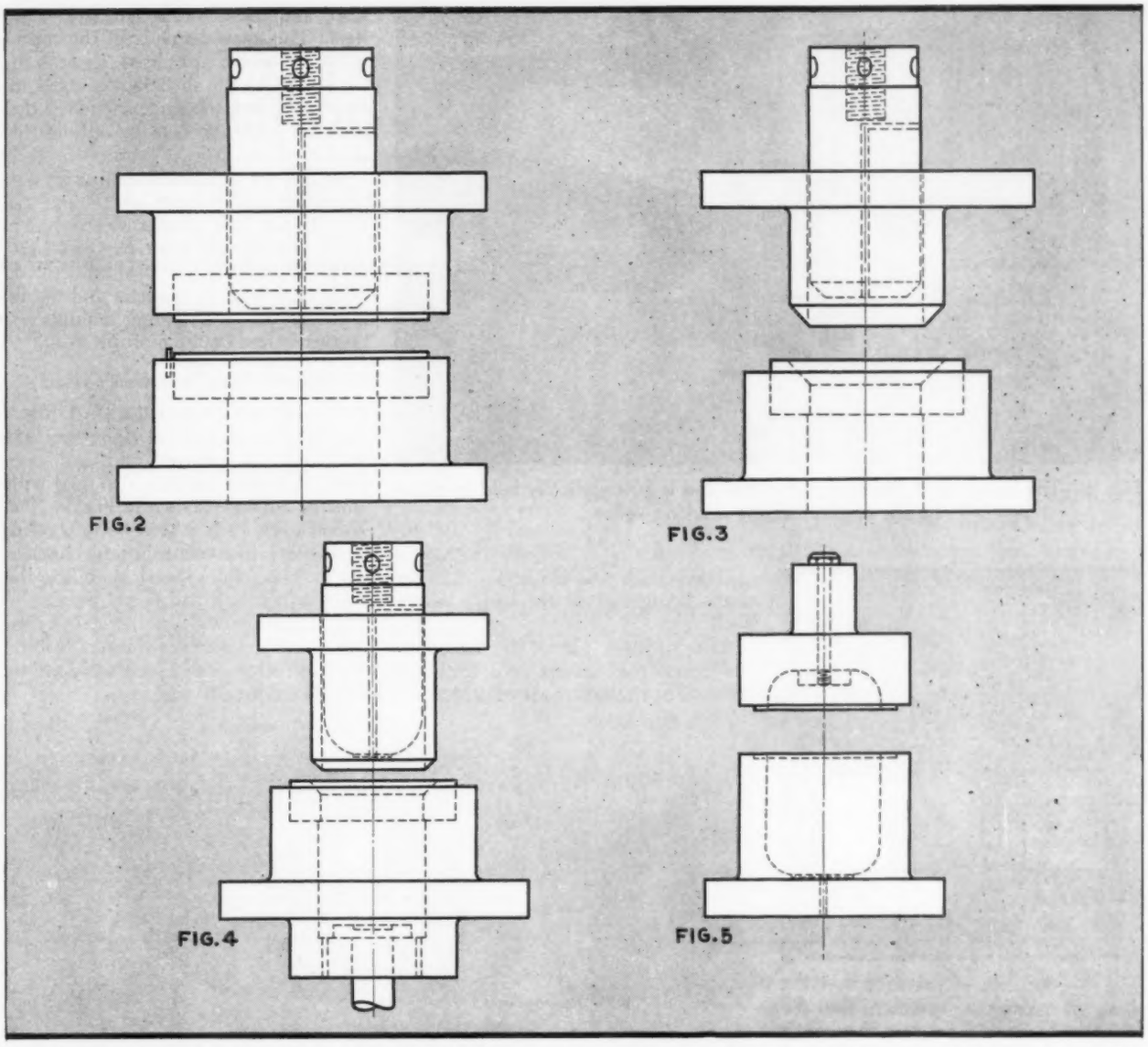


Fig. 2—The first operation die nests the blank between three pins. Fig. 3—Step 2, the second draw uses a cold-rolled steel punch vented to let air escape. Fig. 4—Part of the die used for the third draw extends below the bolster plate. Fig. 5—The closing or curling die is provided with a step on both halves so it can be set easily

novel insofar as part of the die is below the surface of the bolster plate. The die was built this way because of the height of the shell before and after the drawing and also because it was required to eject the shell.

An intermediate bolster plate having an oval opening for the bottom projection of the die is used, and the die is moved forward for removing the shell. The knockout raises it only about two-thirds of the way.

The die shoe is cast iron with an inserted tool-steel ring, hardened and ground. The angle is 45 deg. as in the previous operation. The blank holder is tool steel with a machine-steel back and is hardened for only a short distance at the working end. The punch is cold-rolled steel. The depth of the die is 6 in. from the knockout to the point where the angle meets the straight part of the opening. As the depth of the shell when drawn is 6 in., this insures that the edge of the shell will not go below the edge of the die. The diameter of the shell at this stage is $4\frac{9}{16}$ in. The shell is shown at *C*.

Hardened Edge Removed

The shell next is trimmed in preparation for the closing operation. As the shell leaves the third press operation, the edge is naturally uneven, and the action of drawing has hardened the edge so that about $\frac{1}{2}$ in. is trimmed off to remove this hardened part. If less is trimmed off, cracks will develop when the shell is curled inwardly in the next operation. Allowance for this was made in laying out the work on this shell.

The die used for forming or closing the shell, shown in Fig. 5, is basically a curling die with a large radius on the curling surface. The body of the die is of cast iron and has the exact size and shape of the shell internally; also an air hole to aid in insertion and removal of the shell.

The punch is cold-rolled steel and is machined to a radius of $1\frac{1}{4}$ in. highly polished and pack hardened. A step is provided on the punch and a similar matching step on the die to aid in setting the die. A rubber cylinder is used in this die which in operation is compressed by the disk attached to the punch. The pressure is required to hold the bottom of the shell in shape and prevent buckling under the curling

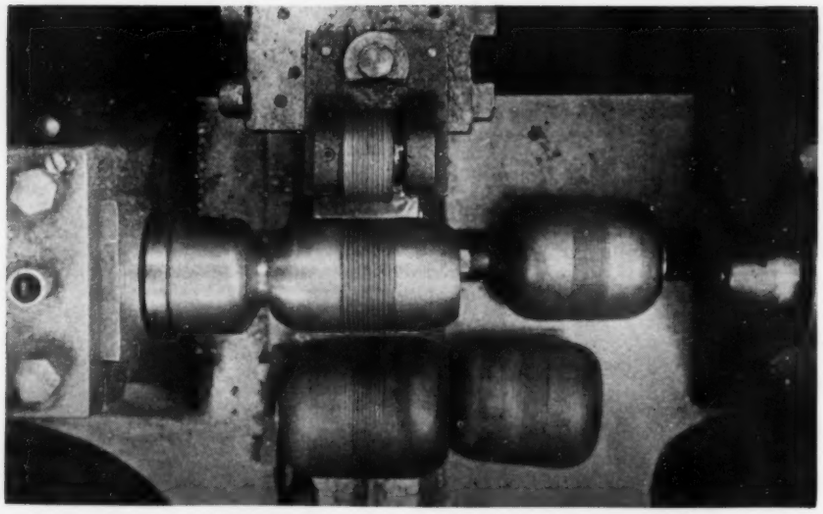


Fig. 6—The hollow shell fits over a mandrel and is automatically held in place by the contact of the marking roller

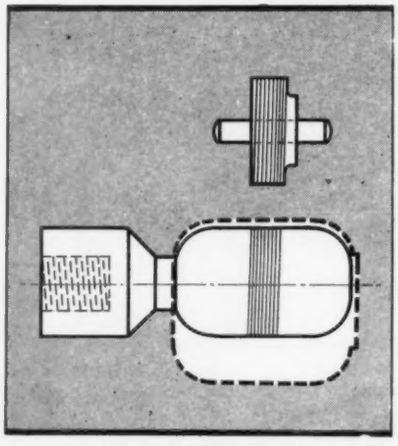


Fig. 7—Because of the fact that the shell has a small opening, the die must be designed to pass through it

pressure. The rubber is 3 in. in diameter and 5 in. long. The shell is closed in to an opening $3\frac{3}{16}$ in. and then has a height of $5\frac{1}{4}$ in. The formed shell is shown at *D*.

Grooves Rolled On Shell

The next step is that of rolling the lines or grooves on the shell. These lines are purely ornamental, but putting these lines on the shell is a matter that required considerable study, because the opening is $1\frac{1}{2}$ in. smaller (approximately) than the diameter of the shell. The lines could not be put on before closing the shell opening as this would cause the shell to buckle during the closing operation.

In Fig. 6 can be seen how the operation was worked out. Fig. 7 is a schematic layout of the chuck and roller with the dotted outline of the shell. Since the opening of the shell is $3\frac{3}{16}$ in., the chuck was made $3\frac{1}{16}$ in., the shape being that of the inside of the shell.

The birds-eye view (Fig. 6) shows the actual tool set-up in a trimming lathe. The chuck is made of cold-rolled steel, and the roller is hardened tool steel. The small diameter of the chuck is $1\frac{7}{16}$ in. which just clears the neck of the shell. As the shell locates itself in position when the roller touches the shell, no provision is made to hold the shell in place.

At *E* is the completed shell ready for polishing and plating. At *F* and *G*, Fig 8, are two similar deep drawn shells that, for the most part, are handled the same as the shell described. Shell *G* is 4 in. in diameter and $6\frac{1}{2}$ in. high before closing and requires an unusually fine example of die work.

Hinged Dies Sometimes Used

Closing this shell was handled differently than for shell *E*. The die was split and had a hinged joint and lever lock. A rubber barrel is also used with this die which is shown in Fig. 9. The closed opening is $3\frac{3}{16}$ in. as in shell *E*, and the radius on the closing punch is $\frac{7}{16}$ in. The chucks used in rolling the lines on shells *E* and *G* can be seen in Fig. 8 together with another chuck used for a similar rolling operation. Rolling lines or other designs can be done on other than parallel surfaces.

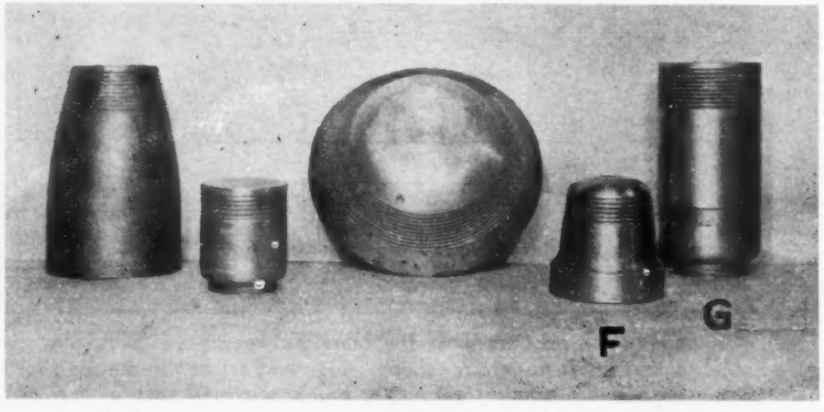


Fig. 8—Shells, such as these at *F* and *G*, may be drawn and marked by tools similar to those described

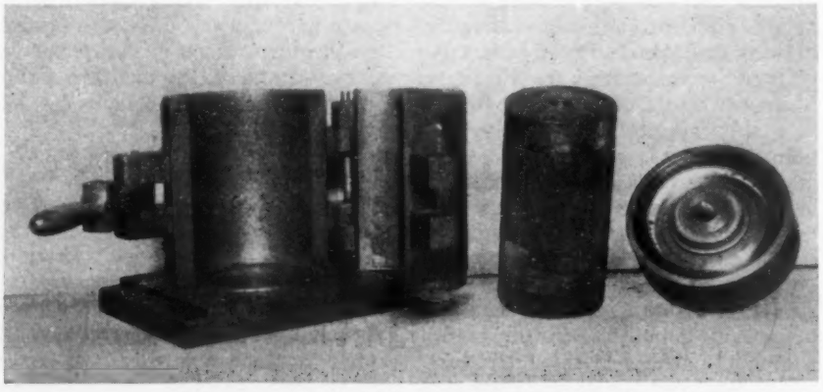


Fig. 9—A hinged die is used for closing shell *G*; a rubber barrel supports the long side wall during this operation

The Aviation Industry is doing its job...

A Year's Production A Week — Every Week

A MERE hundred planes a month in 1938; 200 in 1939; 450 in 1940; 1,600 in 1941, and today, as this is written, plane production goes on at a rate of 5,000 a month. A previous year's production now in one single week — every week.

So begins the story of the greatest industrial expansion in history; an industrial miracle that far surpasses anything our enemies ever have done or can do. Not only did we out-produce the Axis but the acceleration in our production during the past 12 months exceeded the greatest increase in German output during their forced-draft war preparation of 1939, when their production rose from 1,100 to 1,600 planes per month.

The toughest part of our job was accomplished in 20 months. We boosted deliveries from 100 or so to 1,000 planes a week, passing the combined Axis powers. Today, Germany's curve is flattening; ours is climbing steeply. Lt. Gen. Henry H. Arnold, Chief of the Army Air Forces, assures us that Army contractors will produce not less than 148,000 planes in the remainder of 1942 and in 1943. During that same period Navy contractors will turn out at least 37,000 additional planes.

Manpower in the airframe, engine and propeller industries was increased from 125,000 to 450,000 workers during the past 20 months, with the prospect that the industry will be employing more than 1,000,000 men and women in 1943. Many manufacturers are solving their personnel problems by recruiting women workers. More than 40,000 of them — teachers, stenographers, waitresses, housewives and school girls — today are welders, assemblers, machine operators and inspectors on aircraft production lines. Productive floor space in the airframe, engine and propeller industries expanded from 18,000,000 sq. ft. to nearly 55,000,000 sq. ft. during the last 20 months. Further expansion to more than 60,000,000 sq. ft. may be expected this year and an ultimate figure of more than 100,000,000 is a distinct possibility.

To grasp the full magnitude of this task we must remember that a single medium bomber has 30,000 parts, which are built into 650 minor sub-assemblies to make 32 major sub-assemblies. The entire process involves 30,000 man hours of labor. Each of the two engines in this plane requires 50,000 specialized inspections. Every one of the 50 instruments entails many hours of precision workmanship. Yet today there is one factory turning out 4 bombers every day. Another produces fighters at the rate of nearly 20 a day.

To the amazement of the entire world these manufacturing miracles were accomplished without sacrificing the high standard of American aeronautical equipment. There has been some loose talk about the quality of our combat airplanes as compared with those of our allies and our enemies. Indisputable evidence of the superior stamina of our aircraft under fire is written between the lines of almost every war communique. Every battle record tells a story of heavy losses inflicted at small cost upon numerically superior enemy forces. The consistency of this performance on all the far-flung battlefronts constitutes the most eloquent testimony of the high calibre of our designs, our manufacturing methods and the skill and daring of our pilots.

And let us remember that our decisive victory in the battle of production was not won without headaches and heartaches on the part of management, labor and government.

When the President sounded the call for 50,000 planes in the spring of 1940, the program called for only 5,500 military aircraft. Government and industry reeled from the shock — both determined, however, that it *could and would be done.*

The Army, the Navy and the old Defense Advisory Commission set to work to draft a program. This has been revised many times — upward! Congress then proceeded, more slowly, to modify the laws that would have obstructed the realization of the objective. Then the aviation industry, without contracts, in the face of discriminatory profit-limitative legislation, and with nothing but oral assurances of governmental intentions, went ahead with its Herculean expansion plans. New factories were completed long before facilities-contracts and their funds were forthcoming.

The rugged individualists who had founded and built the aviation industry cast aside their rivalries and embarked upon a period of unselfish cooperation. Priceless engineering experience was exchanged. Material was relinquished for transfer to plants where it was needed more urgently. Successful personnel training methods and experience in the use of women workers were pooled for the benefit of all concerned. During one re-

cent month, the cooperation among eight southern California plants averted more than 1,860 potential bottlenecks in production.

As the lessons of the war dictated the need for greater numbers of particular airplane types, many manufacturers accepted orders for planes designed and developed at rival factories. Striking examples are the long range bombers being turned out by plants where only trainers, fighters or dive bombers formerly were made.

Mindful of the risk involved in educating rivals, thereby creating future potential competition, subcontractors nevertheless were sought and trained by pioneer manufacturers. Makers of toys and wheelbarrows, automatic stokers and linoleum were among those who rallied to the call. Within a year subcontracting rose from 13 to 36 per cent of the total program. It still is rising.

When the automotive industry came into the picture, aviation manufacturers gave generously of their time and knowledge to start the newcomers. Liberal licensing arrangements enabled them to reap the full benefits of technical developments. Automotive engineers swarmed through the aviation plants in search of the exacting "know-how" of the aeronautical industry.

Each type of aircraft that reaches the production stage is the result of long periods of research, design and development. The unseen workers toiling in the wind tunnels and the laboratories of government and industry are the unsung heroes who tirelessly are striving to surpass all previous efforts. Their brilliant accomplishments are eloquent testimony of the superiority of men and women who are blessed with freedom of action and thought. Today more than 20 experimental combat airplanes are under development and will replace older types as soon as they fulfill the exacting requirements of our armed forces. Among these are aircraft that promise to outfight and to out-perform any and all of the much vaunted warplanes of the Axis military machine. And this without loss of production.

Every man, woman and child of all the United Nations may fervently be thankful that those who chart our course in aircraft production have not frozen design to such a degree as to make impossible the immediate adoption of improvements as they come out of these laboratories.

What does this brilliant record mean in terms of final victory?

Every newspaper reader has learned this basic war lesson . . . air supremacy is the essential ingredient of military success. As the balance of air power shifts, so do the fortunes of war.

In those dark days when our output was 500 planes a month, Germany's was 2,000 and the German air force was twice that of our Allies. When we reached 2,000 a month last fall, Germany had advanced to a monthly rate of 2,500. Today, as this is written, we have caught up with the enemy's backlog. The air forces of both sides are about equal numerically and United Nations' production exceeds that of the Axis by 27 per cent. Next summer (1943) both the air force and the output of the United Nations will be double those of all the Axis powers.

That is the pattern of ultimate victory!

The pattern of the peace to follow also is gaining in definition. The airplane has shriveled the world to one-fifth its former size. Its use as an instrument of destruction is but a momentary distortion of the pattern of human progress. Its potential power, as a stern preserver of peace, is beyond imagination. Today's air routes of our Army Air Force Ferrying Command are the international trade routes of tomorrow. Giant airliners, by reducing time and space, will speed fraternity among the nations and disunity will give way to better understanding and goodwill.

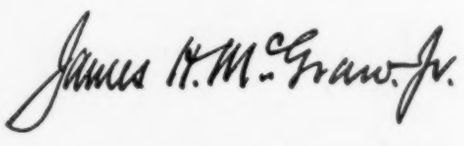
Flying freight trains, with aerial locomotives towing glider boxcars, will serve large cities, decentralizing population and giving to inland cities many of the commercial advantages of seaports. Air mail and passenger pick-up lines will fill the gaps between these transcontinental trunk lines and tie in the smallest hamlets. Universal fly-it-yourself services will provide airplane facilities for those who do not own low cost private aircraft. Roadable rotary wing aircraft and family planes of the fixed wing type may even run household errands.

The coming generation of business men who today is piloting our war planes will find aircraft as essential to business as it now finds them essential to victory.

Commenting on our war production record, Donald Nelson has said, "We are today in the position of men who realize that they are actually doing the impossible".

The mass production miracle that the aviation industry – management and workers alike – has performed through the all-out effort of free enterprise can and will serve civilization in peace as it has in war.

With this boundless new medium of transportation and its concurrent technological developments we shall rebuild our way of life to a rich, new fullness upon the ruins of a war-torn world.



President, McGraw-Hill Publishing Company, Inc.

This is the third of a series of editorials appearing monthly in all McGraw-Hill publications reaching more than one and one-half million readers.

Premixing Practice

BY R. F. APTER and HARRY W. SMITH, THE SELAS COMPANY

Gas and air, when mechanically premixed and closely regulated, assure results from this process

LOCALIZED HIGH-RATE heating of special surfaces on metal parts, which typifies open-flame hardening and annealing, has been done for some years by high-frequency electrical induction methods and by burning acetylene, propane or city gas in the presence of bottled or generated oxygen. Both methods are effective but entail either high original investments for special high-frequency generators or considerable expense in maintaining supplies of compressed oxygen. Gas-air flame treating, on the other hand, permits the controlled selective heating of special sections of a part with regularly supplied fuels (manufactured gas, natural gas or propane) carbureted in long-familiar industrial equipment using only air to support combustion.

Where city gas can be mixed with air and burned to achieve sufficiently localized and accelerated rates of heating, operating economies are considerable. Installation and engineering costs are low in most cases. Further, less time is required to readjust gas-air set-ups for different work pieces, and it has been found that gas-air hardening can produce certain types of work which cannot otherwise be handled.

Flame temperatures attained in air-gas installations are not so excessive that there is any hazard of "burning" the metal, even under prolonged periods of exposure to heat. New gas-air methods do, it is true, offer rates of localized part heating higher than attainable with conventional methods of burning premixed gas and air which is the reason for many recent successes with the method. But flame temperatures have not been sufficiently elevated to endanger the metal part by the overheating so essential to guard against when burning fuels with pure oxygen. When the region to be hardened on a given work-piece includes sharp projections or protruding parts of light section, oxy-gas heating can decarburize, burn, or actually melt down the metal at edges and corners.

To overcome this tendency of oxygen-using flames, work pieces (such as gears with teeth of pitches too small

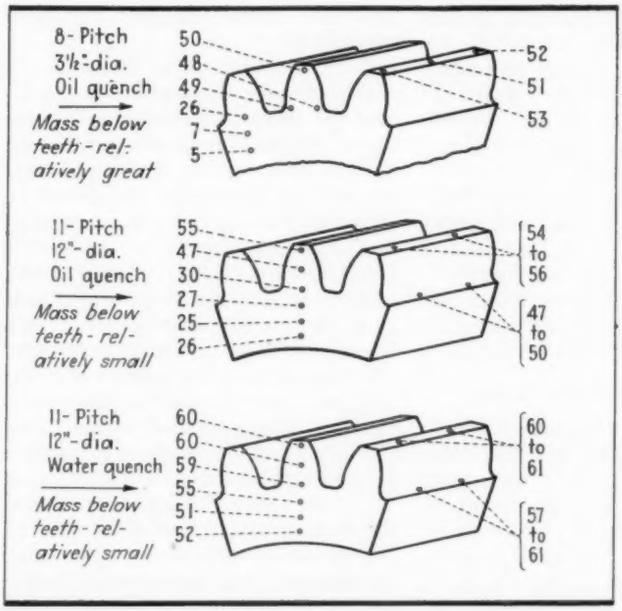


Fig. 7—These three sketches show the rate of transition between hardened and unhardened portions of test gears, two of which were quenched in oil and one in water. The circled values are Rockwell C hardness numbers at the points indicated

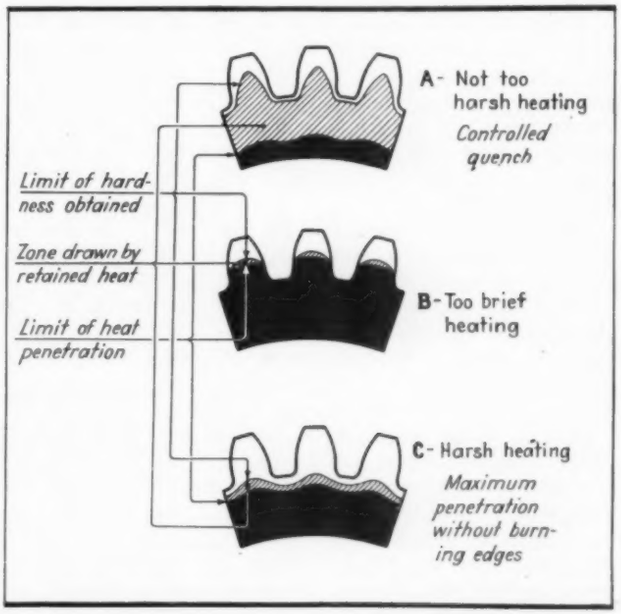


Fig. 8—Proper selection of quenching time and temperature gives final hardness contours like those at *A*. *B* is the condition ordinarily attained when the heating period is too brief, while *C* shows the whole-tooth hardness when the heat is allowed to penetrate too far

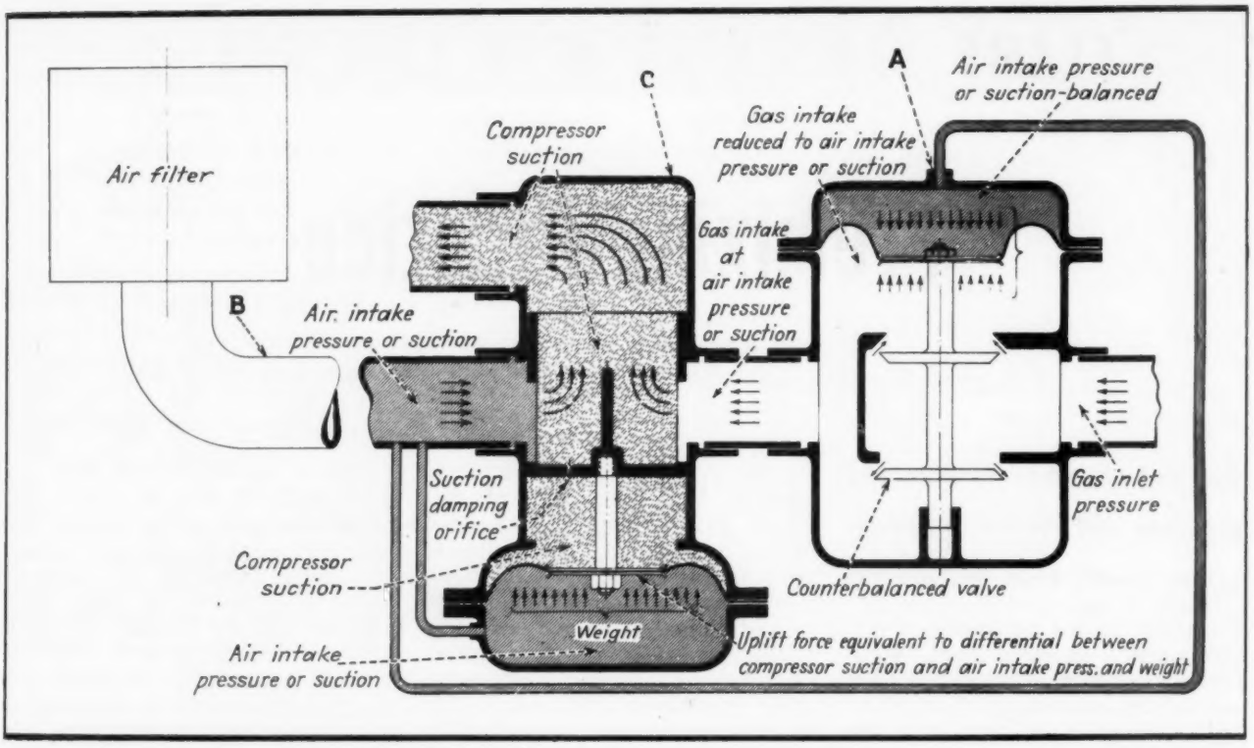

Air filter
B
Air intake pressure or suction
C
Compressor suction
A
Air intake pressure or suction-balanced
Gas intake reduced to air intake pressure or suction
Gas intake at air intake pressure or suction
Suction damping orifice
Compressor suction
Air intake pressure or suction
Weight
Counterbalanced valve
Gas inlet pressure
Uplift force equivalent to differential between compressor suction and air intake press. and weight

Fig. 9—Compacted and radiant types of flame-hardening unit require gas and air mixing systems which incorporate integrally designed compressors in the mixture line. Gas is delivered to a governor *A* where it is reduced in pressure to that existing in the air intake *B* to the mixing valve *C*. Fuel-air ratio is automatically maintained

for location of burners between adjacent teeth) need to be rotated rapidly with respect to the flames. With gas-air combustion these speeds of rotation can be materially reduced; in fact all movement between burners and parts to be hardened can often be eliminated. One important benefit of this slowing down (or elimination) of motion between heat source and workpiece is that the flame is given a greater opportunity to penetrate into interstices and depressions, such as between gear teeth.

Another factor responsible for the improved penetrating power of gas-air burners is the radiant component of the heat output from late burner designs. Radiant heat energy travels with the speed of light into every recess which can be "seen" by the burner even though the recess may be a "pocket" within which it is difficult to circulate hot combustion products.

Certain users prefer the somewhat less harsh heating of gas-air flames because it develops a more gradual transition of hardness (and brittleness) over the heat-line; that is, the microstructure changes (from the hardened Martensitic surface to the soft core) are less sudden. Fig. 7 shows the rate of transition between hardened and unhardened portions in two gears ($3\frac{1}{2}$ in. dia. by 8 pitch, and 12 in. dia. by 11 pitch, respectively). In the latter case, both oil- and water-quench results are given.

Further demonstration of the ability to control gradual transitions from hardened surfaces to unhardened cores is given in the accompanying table, which cites results obtained by H. C. Wagner and A. L. Thayer in recent studies at Brown University. A line of three gas-air burners of the "superheat" or "compacted" combustion variety was used to harden one face of $\frac{1}{2}$-in. square bars of 0.90-carbon tool steel. In this case the rod was translated longitudinally along the burner line at slow speeds and progressively hardened by a high velocity stream of water directed at the work within $\frac{1}{4}$ to $\frac{1}{2}$-in. of the last burner in the line.

Heating Small Gear Teeth

Fig. 8 illustrates still another advantage of more moderate heating rates. The natural tendency of a high heat source is to heat the teeth of small pitch gears (8-pitch or smaller) as in the center sketch of Fig. 8. Therefore, it is common practice to keep the gears spinning until the heat penetrates to the point shown in the lower sketch. Upon quenching, all heat is quickly removed from the tooth interior and whole-tooth hardness is obtained—which is not the most desirable condition from the standpoint of breakage.

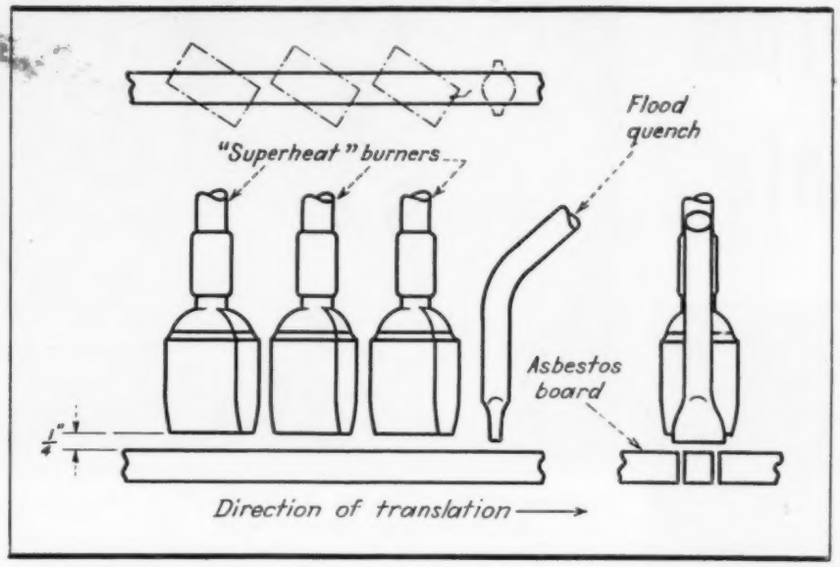
Less harsh heating methods develop heat lines as deep as shown in the top sketch without burning the edges of the teeth. Enough heat is retained deep in the body of the gear to "self-draw" the core metal during controlled quenching.

Over and above the characteristics of the hardened part itself, gas-air methods have manufacturing advantages. Skilled operators are not required; no space nor working time is needed for the storage and handling of bottled fuels or compressed oxygen; fuel supplies are continuous and almost everywhere available; piping and manifolding are extremely simple because only one-pipe supply is needed at each burner; the labor and mechanical complications of handling parts in lead and salt baths are eliminated; no special electrical wiring or maintenance is involved; and the floor space required is kept to a minimum.

On the other side of the ledger is the relative larger size of burners required for a given job (as against oxy-gas burners) and the consequent difficulties of "combing" individual teeth on large gears and the like.

Because the essence of flame-hardening and flame-annealing in open air is localized heating at such high rates that no distortion nor significant scal-

PROGRESSIVE FLAME HARDENING WITH GAS-AIR COMBUSTION



Depth Below Hardened Surface (Inches)	SCLEROSCOPE HARDNESS	
	Test A	Test B
0	80	80
0.01	75	74
0.02	74	60
0.03	70	55
0.04	71	55
0.05	65	40
0.06	60	35
0.07	48	33
0.08	45	Soft
0.09	45	
0.10	45	
0.11	43	
0.12	40	
0.13	35	
0.14	33	
0.15	Soft	

Data based upon tests conducted by H. C. Wagner and A. L. Thayer, May 1942, Brown University, Providence, R. I.

TEST CONDITIONS

Burners: Three refractory-slot burners.
Fuel: 530 Btu. manufactured gas premixed with air at 4½:1 ratio.
Specimens: ½-in. square bars of 0.90-carbon steel.
Quench: Water flood at room temperature. Located just beyond end burner.
Test A: Rate of translation of specimen —3 in. per min.
Test B: Rate of translation of specimen —4 in. per min.

ing nor decarburization can occur, it is essential to burn as much gas as possible through each burner. To so crowd into each burner as much fuel as can be completely combusted requires a high manifold pressure—the pressure of premixed fuel just ahead of the burner.

The "compacted" and "radiant" flame-hardening units operate effectively and satisfactorily at manifold pressures up to 2 lb. per sq.in. of fuel-air mixture. This pressure requires gas and air mixing systems with integrally designed compressors in the mixture line. A popular type of unit successfully used in flame-hardening is diagrammatically illustrated in Fig. 9. Such units can supply a large number of burners—all on the same supply line yet capable of simple independent adjustments without affecting one another.

Gas is delivered to a gas governor *A* where its pressure is reduced to exactly that existing at the air intake *B* of the mixing valve *C*. If the filter on the inlet air pipe should have measurable resistance to the flow of air by virtue of its construction or accumulations of dirt after long service, the pressure just ahead of the mixing valve, at *B* may be less than atmospheric. This condition will be automatically reflected in the gas pressure at the outlet of the governor *A*, and will not affect the ratio of air and gas which are mixed for combustion. With such a system, neither variations in inlet gas pressure nor in atmospheric pressure will affect the fuel-air ratio.

The mixing valve *C*, through which gas and air supplies are drawn by a compressor (not shown in the diagram), incloses a precision piston (or sleeve) which may be rotated by an external vernier adjustment to change the relative port openings exposed to the gas and air intakes. The movement of this piston up and down is controlled by suction from the compressor, or in other words, the demand of the burners. During such vertical movement of the piston or sleeve, the relative port openings for gas and air (machined to close tolerances for this very reason) are not varied. Once the vernier adjustment is set for the desired mixture, the volume ratio of gas and air mixed in the unit is not affected by variations in the amount of fuel required by the burners. It is not necessary to lubricate this sleeve-type of mixing valve.

The compressor is of the positive-displacement blade type; a bypass pressure regulator is provided so that the outlet mixture of gas and air delivered to the burners is maintained at constant pressure irrespective of the number of burners which may be turned off or on. The outlet pressure is adjustable by simple settings of the outlet mixture regulator. For turbine-type compressors, no outlet pressure regulator is required.

Such equipment is available in several designs and sizes, with maximum mixture capacities ranging all the way from 325 to 20,000 cu.ft. per hr.—and up to 60,000 cu.ft. per hr. or more if turbo-compressors are employed. In each case air-gas ratios and delivery pressures are automatically maintained over the entire capacity range.

Low-pressure-air inspirators, high-pressure-gas inspirators, mixing T's, dual-port proportioning valves or other popular methods of premixing gas and air for combustion in furnaces, are not generally capable of delivering premixed gas and air in exact and constant ratio at pressures above ½ lb. per sq. in. Burners generally used for flame-hardening will actually operate with such combustion control equipment, but it is not possible to use them to their intended limits of capacity, unless mixture pressures well upward of 1 lb. per sq.in. are practicable. If gas-air burners designed for flame-hardening are not operated at the full capacity (i.e., at the high premixture pressures for which they are built), an unduly large number of burners and unacceptably slow rates of heating will result.

Unless full machine-premixing methods are employed it will not be possible to adjust the heating rate of any one burner (to accommodate for variations in metal mass, heat losses at part boundaries and temperatures required) without affecting the adjustment of other burners.

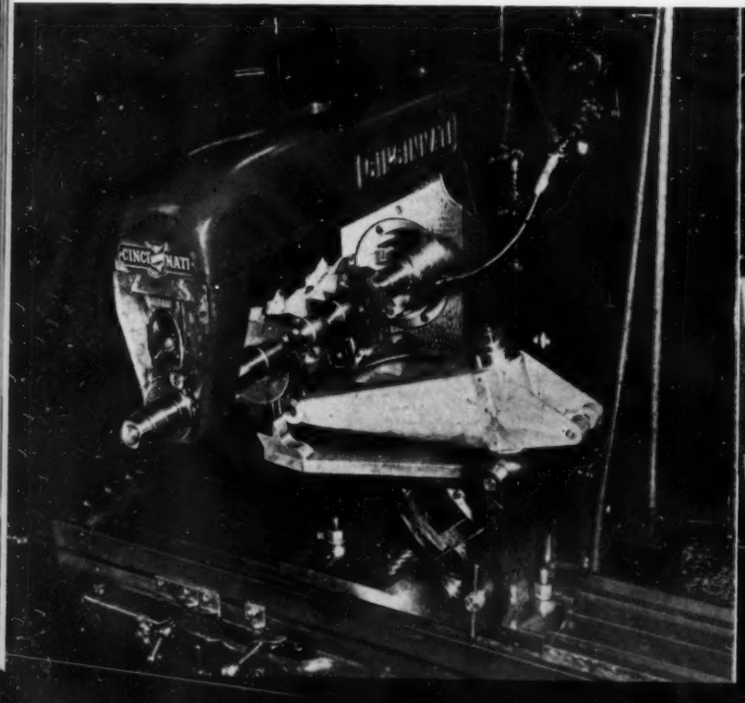
The third installment of this series will appear in an early number.

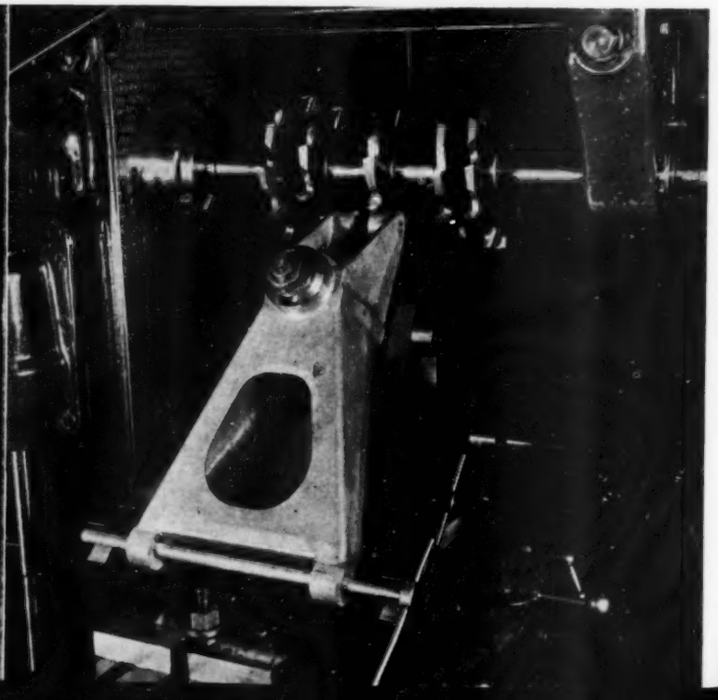
Shop Shots From Aircraft Plants

A bench burring device has helped speed the preparation of aircraft parts for assembly. The machine consists of a motor mounted on a base which permits it to swivel through 360 deg. On one end of the armature shaft a flat polishing disk is mounted, covered with abrasive cloth. This disk is convenient in removing the tool marks from

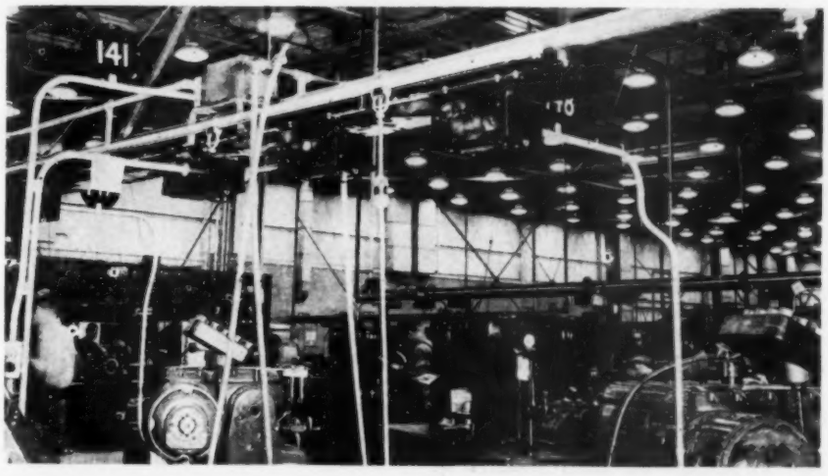
Completed aircraft engines are hauled by small tractors coupled to the engine stands. Formerly the tractor was backed up and the draw bar was guided into the trailer fork by hand and the coupling pin inserted. Mike Westhover, a tractor driver, designed and built a coupling hook that engages itself. It is released when the driver pulls a chain to lift the hook. Wright Aeronautical Corporation.

Tail wheel housings, made of cast duralumin, are machined at both ends in a single set-up in a new Texas plant. Five staggered-tooth cutters are set up on the arbor, and the arbor and fixture bear corresponding numbers so that they are kept together in the toolroom and can be secured quickly when needed. First the fixture plate is swung on its trunnion to the upper position so that four outside cutters can straddle mill the wide end of the housing. The fixture is held in the upper position by a locating pin, and the part is located on the fixture by a bolt through the tail-wheel axis. For the second part of the operation the locating pin is pulled out and the trunnion leaf is lowered to mill the split end of the housing with the cutter in the center of the arbor. When the four outside cutters are dulled, they are reversed in position so that they cut on their opposite sides. North American Aviation Corporation.

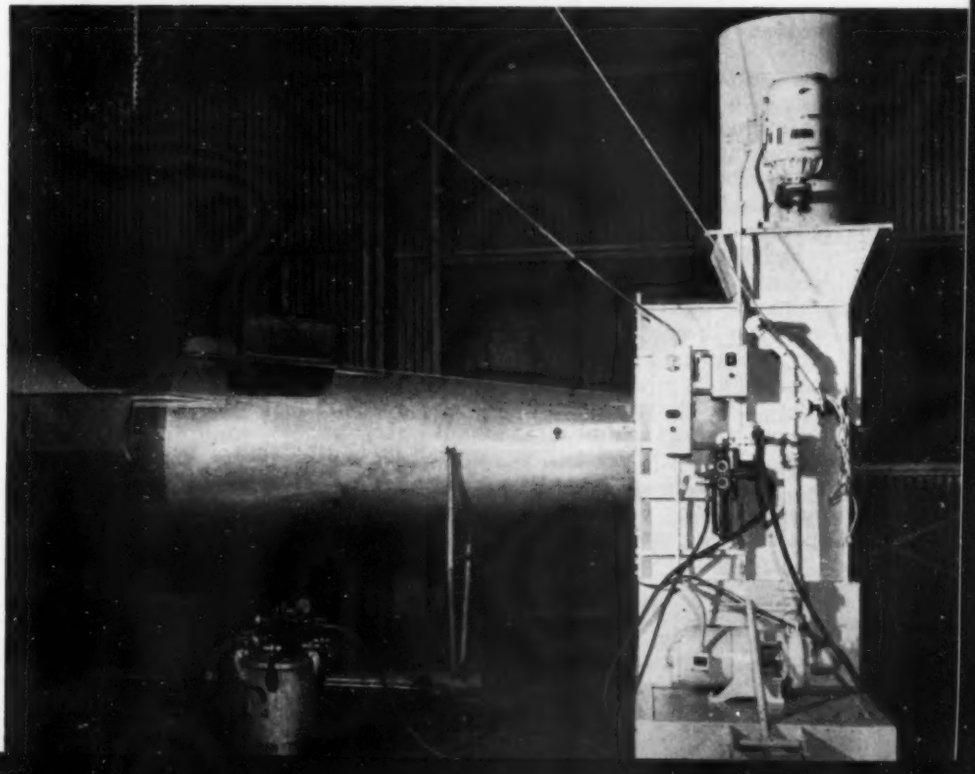




small flat parts. Between the disk and the motor frame, the shaft carries a pulley which drives an abrasive belt around a smaller pulley held on a vertical arm. A tightener pulley may be adjusted to obtain the proper amount of tension on the belt. A small work support makes it easy to hold parts in contact with this belt. Small slots and grooves can be burred and cleaned on the opposite side of the belt which is held well away from the vertical arm. On the opposite end of the armature shaft, a chuck is mounted in which small burring tools may be held. This arrangement forms a convenient way in removing the burrs from the ends of small holes. Vultee Aircraft, Inc.



Bus bars supplying power for motors in the machine shop are supported above the machines from the pipe lines bringing compressed air to the same machines. Compressed air outlets along the pipes supply pneumatic machine fixtures, and nozzles for cleaning out chips. Piping is kept from swaying by guy wires on either side. An electric conduit clipped to one of the vertical pipe lines supplies a bus bar attached to the horizontal section of the air line. These bars are arranged so that outlet boxes may be installed at any point for connecting to machine tool motors. In addition, the bars permit an outlet plug to be snapped on at any point Douglas Aircraft Company.



Fuselage painting on the PT-22 training plane is speeded by using a specially-constructed Binks portable spray booth when painting interior surfaces. The booth permits applying the final inside paint coat on the production line without the necessity of moving the planes to the paint shop. At a convenient point in its assembly, the fuselage is moved on its own dolly to the booth, which is equipped with an air compressor for the spray tank, an exhaust system and a receiver to catch the excess pigment. The tail cone of the airplane fits into an opening in the booth while paint is applied from the other end by an extension spray gun. Ryan Aeronautical Company.

The dies of this tong header or upsetter are in the open position while the furnace man is about to pass two lengths of stock, with ends heated to forging temperature, to the hammerman

A 24-ft. rod issues at forging temperature from the furnace, passes through straightening rolls and enters the dies of this rod header. Streams of water are used to keep the dies cool

Bolts by Hot Heading

BY HERBERT CHASE

A wider choice of materials and size, plus low die cost make hot heading the best means of making certain types of bolts

THOUGH COLD HEADERS are today producing in large quantities bolts and other products once made chiefly by hot-forging methods, the process of hot heading, or upset forging, maintains an established place in the metal-working industry.

Each process has its advantages and limitations, and is adapted for work which the other cannot do either so well or so cheaply, if at all. The Lamson & Sessions Company, like other manufacturers in the field, has departments for each type of work and lets economic factors control the choice of method.

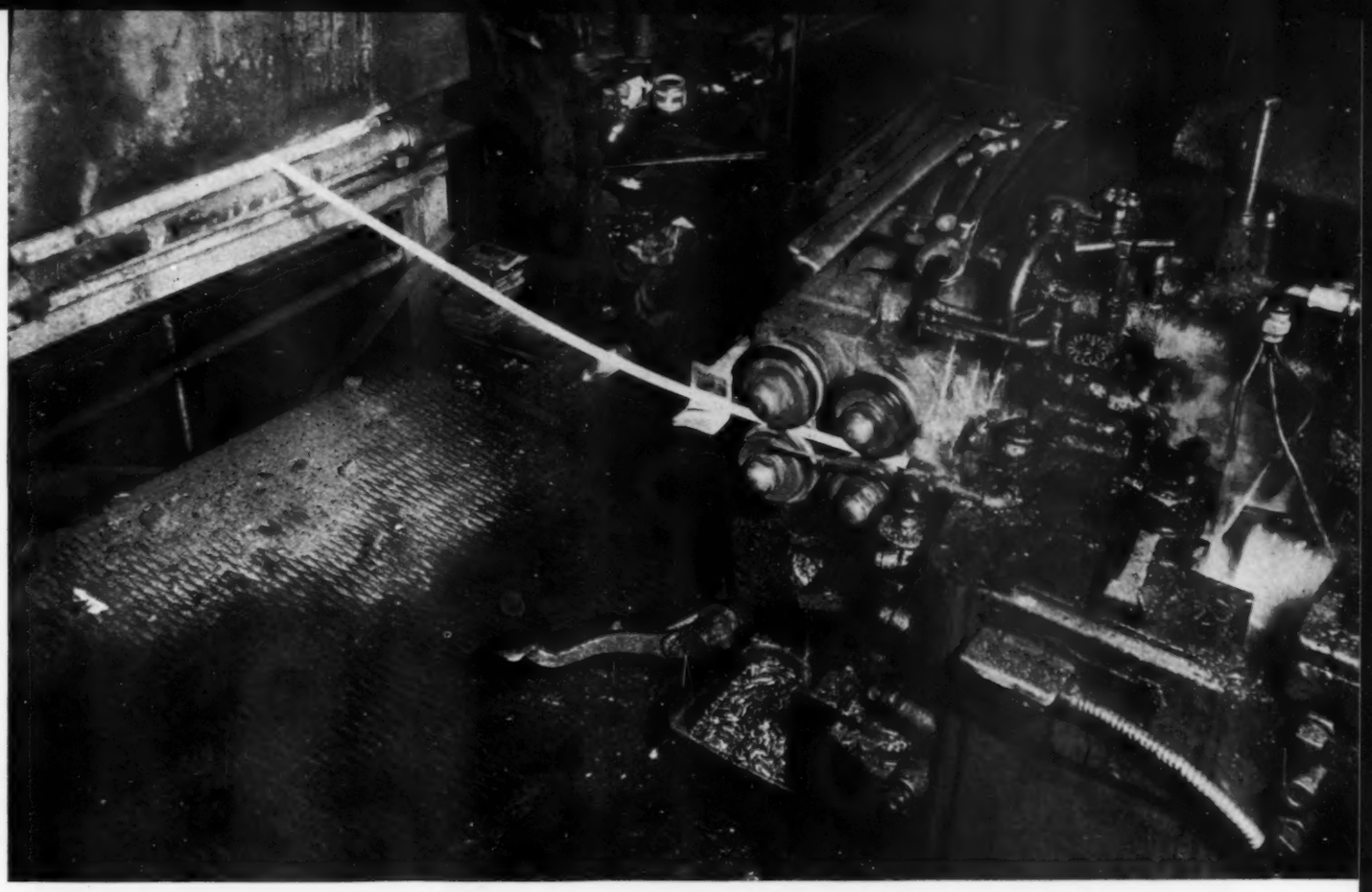
Cold heading is essentially a rapid mass-production process. It requires a special die not only for each diameter and shape but for each length of piece and so is not used unless the quantities required are large enough to justify the die expense. Cold headers make use of cold-drawn wire which is ductile at room temperature. It comes in coils and is run through a straightener on its way into the heading machine.

The first operation is to shear the stock to required length, after which the head is upset in one, two or three blows. The head usually has a circular section, but is commonly sheared subsequently to square or hexagonal shape with only a slight loss of stock. Often the same dies which do the upsetting also extrude a part of the shank to a diameter smaller than that of the stock, an operation not performed in hot heading. Cold heading is seldom done on stock over 1 in. in diameter or over 6 in. in length. A major proportion of the work is $\frac{1}{2}$ in. in diameter or less. Finish is excellent and close dimensions can be held. Head size is usually not over $2\frac{1}{2}$ times stock diameter.

Much hot heading is done on stock from 1 in. to $2\frac{1}{2}$ in. in diameter, but some is also done on small diameters down to $\frac{3}{8}$ in. or less. Such work is chiefly on products not required in sufficient quantity to warrant a cold-heading die or when the length exceeds that which it is feasible to handle in a cold-heading machine. A hot-heading die having standard dimensions can be used for any length of bolt above a certain minimum and the head is usually upset to the shape required though some flash has to be trimmed off.

Straight bar stock is employed in hot heading and is generally cut to length before it enters the heading machine. All stock is heated to forging temperature (though often only the end to be headed is heated). This necessitates a furnace for heating and one extra man to handle the stock into and usually out of the furnace. Hot heading is done less rapidly than cold heading and labor charges are higher. Die cost, when a standard die can be used, is lower.

Any material which can be hot



forged can be used in hot heading. The range of materials suitable is wider than for cold heading. Much hot heading is done in a single blow, but in other cases, two to six or more blows may be required. Hollow and some other shapes of heads rarely produced by cold heading can be hot headed. The maximum diameter of head is usually about 2½ times stock diameter. Offset heads, not symmetrical about any axis, can be formed. Cranked parts are also produced.

One Method Like Cold Heading

One form of machine used for hot heading products, such as rivets and bolts, operates much like a cold header in that it shears the stock to length and heads it automatically. Rates up to about 135 pieces a minute are sometimes attained and stock which cannot be cold headed can be used.

For this "rod" machine, the length of piece is limited, much as for cold heading, but the stock is in bars 24 ft. in length. They are fed from a long furnace after reaching forging temperature and pass directly into the machine, which is placed only a few feet from the furnace and with its dies level with the furnace hearth. Both the head and the shank of the forged piece are at forging temperature. When the product is to be heat-treated it slides down a chute into a quenching solution through which it is carried and from which it is later discharged by a conveyor ready to be delivered to a drawing furnace. Jets of water are used to keep the dies cool in this machine.

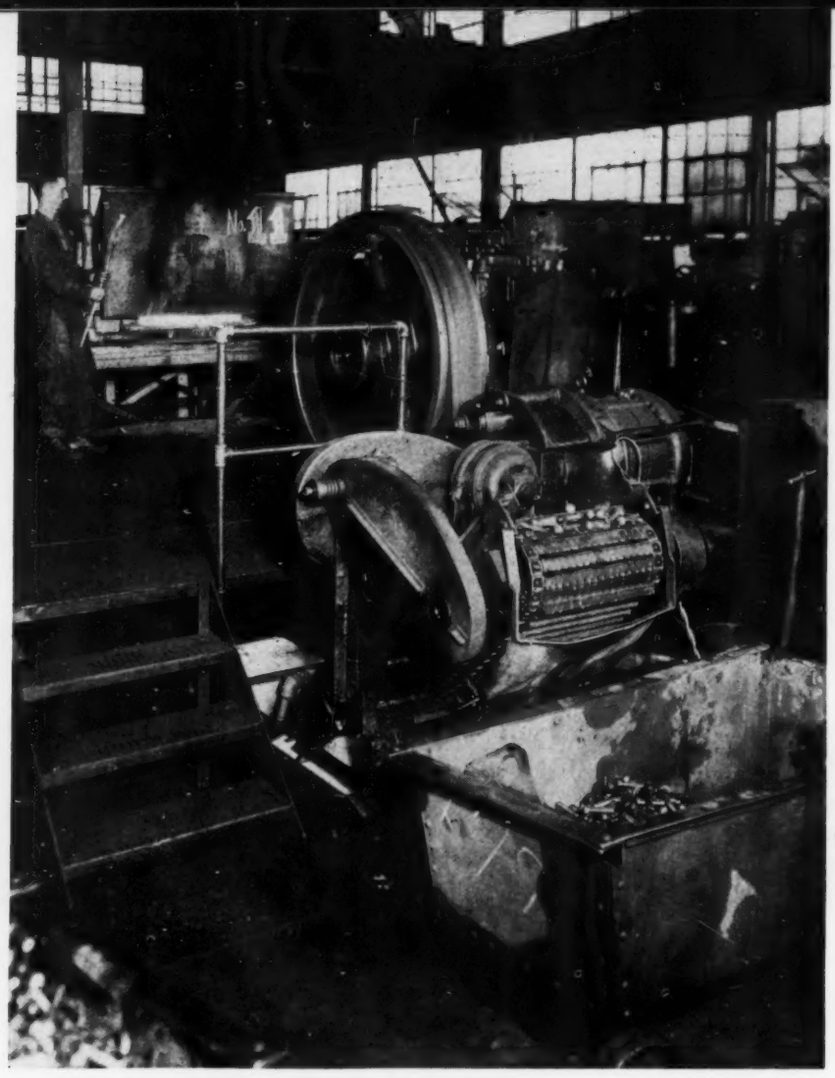
A large proportion of hot-headed parts are produced in standard forging machines also called tong headers, into which the stock, heated only on the end to be upset, is fed, one piece at a time. Headed parts are ejected by tongs with which the hammerman grips the outer end of the piece. If more than one blow is required, the hammerman shifts the piece from the first to as many successive positions in the die as may be needed to give it the required shape. The die is split and is opened and closed by the machine. When in closed position, the hammer, shaped as required, advances and upsets the head against the outer portion of the die which is recessed to shape all or a part of the head. Jets of water play on the dies to keep them cool. When a hollow head is required, the hammer carries a corresponding projection, to piece the recess.

If a larger upset is required than can be formed in a single blow, the first and perhaps a second blow usually shapes the rod end like the frustrum of a cone and the succeeding blow or blows form the head to the required shape. The head can be circular, square, hexagonal, spherical, half round or of other shape. Y and T shapes are readily made and other odd shapes, some of which are not symmetrical with the axis of the piece, can be produced. Many pieces, such as socket wrenches, are made with hollow heads to fit square, hexagonal or other nuts or mating parts. If required, the end can be offset or bent at an angle in the final blow. The depth of a hole pierced and formed, is commonly not over 1½ in. or say twice the diameter of the punch.

Removable Inserts Handy

Dies for parts of standard shape can accommodate different lengths of shank as long as the latter is long enough to afford a tong-hold. Many dies are made with removable inserts which are taken out and ground when necessary and one set of holders may handle inserts for producing different shapes or diameters of head. Partly for this reason, it is feasible to make rather short runs, say of only 100 or even fewer pieces, though there is naturally a preference for longer runs. The same die can be used, however, for any number of lengths above a given minimum.

When forging, the upsetter usually runs continuously at a uniform speed which is set to give the hammerman time enough to handle the piece and shift it as required for each blow needed. Blanks, headed to the required temperature, are supplied by a furnace man who lays them on a plate conveni-



Flash is trimmed from hot-headed bolts in this press, after the pieces have been cooled to room temperature

ent to the tongs of the hammerman. The furnace man must judge the temperature within reasonable limits. He times the delivery to the speed of the machine and of the operator doing the upsetting. In addition, the furnace man must keep the furnace supplied with blanks which have attained the proper forging temperature. In some cases, especially if the forging temperature is high, separators are used between blanks so that they will not weld or stick to each other when taken from the furnace.

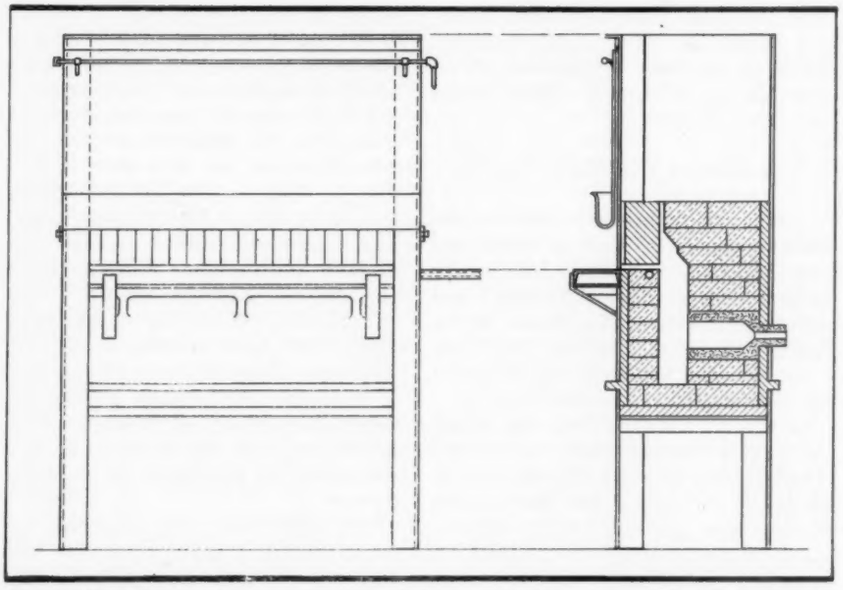
Special Furnaces Are Used

Each machine has its own furnace which is set to hold the approximate forging temperature required. This is done by adjusting the supply of natural gas which a shop compressor has raised to a pressure of 30 lb. per sq. in. Burners are arranged so that they draw in the required amount of air and burn with a slightly reducing flame to minimize scale formation. Each furnace is set at a convenient angle and position in reference to the upsetter it serves.

Furnaces are designed especially for the job and have a narrow throat a few inches above the water-cooled hearth over the edge of which the ends of the blanks to be heated project. The arch of the furnace has its bottom face about 3 in. above the hearth and the back wall of the furnace has the tiers of bricks stepped back so that the width, which is perhaps 12 in. at hearth level, is double that at the burners some 2 ft. below. The hearth is the same width as the thickness of the arch and, being water cooled, helps to protect the arch against rapid deterioration.

Blow Box Supports Blanks

Next to the hearth and outside the furnace is a blow box the top of which is level with the hearth and supports the outer ends of the blanks which lie on the hearth but overhang it, if they are long, at both sides. The blow box is hollow and is fed with air at a low pressure. This air issues from holes in the upper face of the box and helps to keep the outer ends of the blanks cool and also to prevent the furnace flame from blowing into the room. This arrangement together with a water shield a few inches in front of the arch protects the furnace man and hammerman from excessive heat. Most furnaces have hearths about 8 in. wide and 5 ft. in length. Blanks are so placed that only the length to be upset extends into the furnace and attains a forging temperature. This conserves fuel and also



Front elevation and cross-section of furnace designed especially for heating the ends of blanks to be hot headed. A blow box attached to the outside of the furnace level with the hearth helps keep the ends of the blanks cool, and together with the water shield on the front protects the furnace man from excessive heat. Blanks are inserted in the furnace through a small opening so that only the portion to be hot headed is heated

helps to keep dies at lower temperatures.

A given furnace and upsetting machine are used continuously on the same or about the same diameter of stock as much as possible, to minimize the number of die changes required and permit the furnaces to run with minimum change in adjustment. The rates of production vary with the size of stock, amount of upset needed, and number of blows required, but range from about 1,400 pieces an hour for single-blow heading on $\frac{3}{8}$ in. stock to perhaps 100 pieces an hour on 2-in. stock needing four blows for upsetting and shaping.

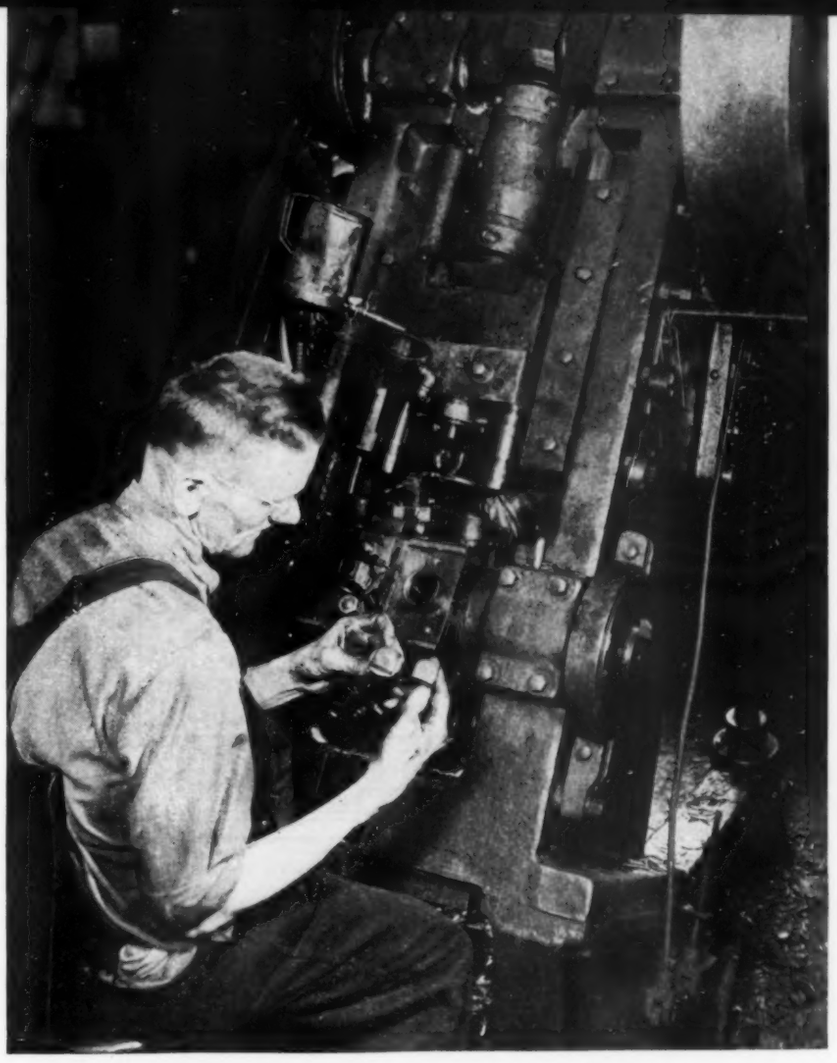
Flash Sheared After Forming

After completing an upset, the piece is usually thrown into a chute and slides into a metal tote box to cool. When a batch is completed, it is removed to a department where flash is sheared off either in a standard bolt-trimming machine or by forcing the bolt head through a trim die in a punch press. If straightening of shanks is required, the forgings are sometimes run through a thread-rolling machine equipped with flat dies instead of threading dies. This may improve the finish as well as straighten the shank. Shanks which require threading are usually put through thread rollers equipped with threading dies. If pointing is needed, it is done before threading.

Except for flash removal, operations which follow upsetting (and straightening, when needed) are much the same as for cold-headed products. Threading, crossdrilling and other machine work is the same as for cold-headed products. If dimensional limits required on the hot-headed parts are as close as can be held in cold heading, more machine work is likely to be needed on the hot-headed part.

Many hot-headed, as well as cold-headed products undergo heat-treatment. The specific heat-treatment naturally depends upon the steel used and the customer specifications to be met. Many hot-headed products are used successfully without heat-treatment, but the need for saving steel and the higher physical properties which heat-treatment provides is today increasing the proportion of headed products being heat-treated. Even with carbon steels it is feasible to secure, by appropriate heat-treatment, physicals above those specified until recently on some headed products made from low alloy steels. This is naturally an important consideration when alloy steels are greatly restricted in availability.

One of the steels much used in hot heading contains 0.14 to 0.22 percent carbon and is fairly high in sulphur, the limits on which are 0.075 to 0.220 percent. Phosphorous is held to 0.045 percent maximum. The range on manganese is 0.60 to 0.90 percent. This steel has the advantage of low cost and good forging properties and its physical properties are adequate for a considerable diversity of hot-headed parts. It is usually forged at about 2,000 F. Much of the stock used in continuous hot rod heading of 24-ft. bars up to 1 in. in diameter, is done on steel having 0.35 to 0.40 percent carbon.



Bolts made in the rod header drop into a quench tank below floor level. A conveyor carries them from the quench and discharges them into a tote box

Aircraft-Fixture Foundations

"Getting down to earth" suggests solidity; but as a matter of fact the earth is not always so solid as it seems. Here is a case in point.

Master mechanics and layout engineers of an automotive company producing components of the Martin B-26 bomber ran into an unexpected problem. One Friday night the first huge holding fixture for part of the bomber fuselage was completed. The engineers checked it and pronounced it perfect. On the following Monday morning they checked it again only to discover that it had somehow warped out of shape, despite the fact that it was a steel structure solidly anchored to a concrete foundation. That week the necessary adjustments were made, and on Saturday, the structure was once more perfect. But, on Monday morning, it was again askew.

All work on the fixtures was then stopped while an investigation was launched. After considerable sleuthing the trouble was traced to the fact that, during each weekend, there was considerable switching of railroad cars onto a neighboring railroad siding. The vibration thus set up was carried into the earth under the factory foundations and from them through the floor into the fixture.

So the fixture had to be dismantled and placed on a foundation of its own which, sunk deep into the earth, was insulated from all contact with the building. All other fixtures were then built in the same way.

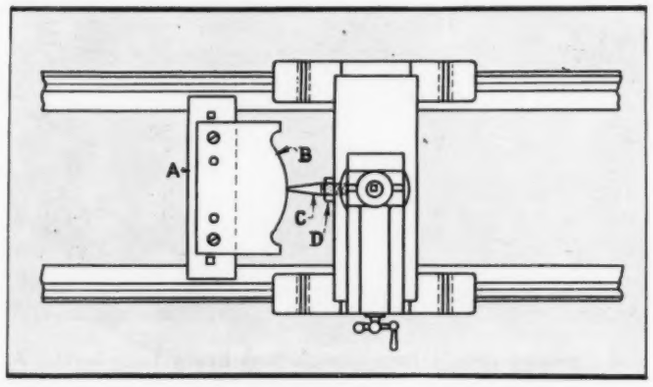
IDEAS FROM PRACTICAL MEN

Attachment Duplicates Contour

BY JOHN J. O'WRIL

The arrangement shown in the drawing was developed for duplicate contour facing on a lathe. A piece of steel *A* is cut to fit inside the lathe bed and fastened by two capscrews connected to a plate underneath.

Templet *B* for a particular part is cut in the contour of a diameter through the part. Although only one half of this contour is necessary for lathe work, the use of the full shape assists in accurate duplication.



A tracer fastened to the cross-slide of a lathe makes duplicate contour facing possible

Tracer *C* is made from a hardened screw pointed at the end. A hole is drilled and tapped in the center of the cross-slide at the bottom and the tracer is screwed into this. The tracer is locked in position by tightening locknut *D* down against the cross-slide.

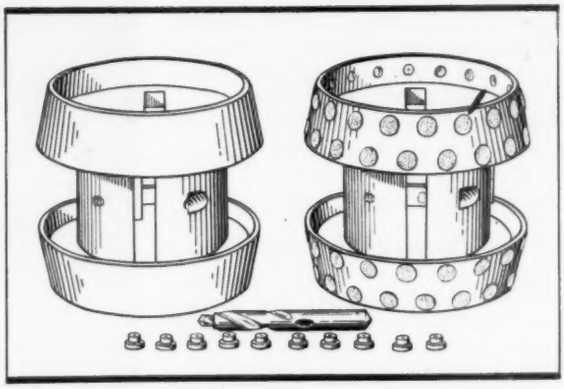
Movement of the tracer along the templet will limit travel of the cross-slide and reproduce the contour of the templet in the work being faced.

Micarta Repairs Screw Machine Clutch

BY J. L. WITCHEY
Westinghouse Electric & Manufacturing Co.

Wear in the clutch body and the friction drive rings of automatic screw machines may be compensated for by an outward adjustment up to $\frac{5}{32}$ in. from the friction backs. However as these rings are adjusted out, wear also shows up in the threads. The result is a low friction ring that chatters and grabs in changing from different speeds.

Micarta inserts in the friction face of the clutch body allow the friction rings to be adjusted back into the friction backs. A two-diameter drill is used to drill the holes for these inserts. In most instances this



Micarta inserts in the friction face of the drive ring at right permits the friction ring to be adjusted into the friction back

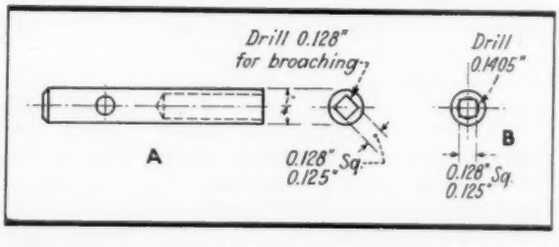
does away with the looseness in the threads. It makes a smoother and quieter operating clutch than the original brass ring and it has been noted that less tension has been required to drive the spindle. Several such repairs have been in service for more than a year, and show no signs of wear.

Chips Removed in Broaching Blind Holes

BY A. LUNDGREN
Vega Airplane Company

When a drawing calls for broached holes provisions must be made for chip removal. The part shown at *A* in the drawing called for a blind hole. It required four broaches in a turret lathe in order to finish this hole, and as the drilled hole was equal to the final width of the square, the operator had to take very shallow cuts (about $\frac{1}{8}$ in.) back out his tool, blow out the chips, and repeat these operations to the full depth of the hole.

Permission was obtained to alter the design as shown at *B*. The use of a larger drilled hole permits the use of one roughing and one finishing broach, and makes possible a punch press set-up. The hole can



Chips are more readily removed from the broached hole in *A* by drilling a hole of the size at *B*

be broached to full depth in one stroke since chips can escape around the sides of the broach.

The design has been improved still further for future orders by allowing the broached hole to go clear through the sleeve. The same clearance for chips is allowed as in the former case. By allowing the hole to go all the way through, a pull-through broach can be used which improves the accuracy of the hole, and also results in manufacturing economies.

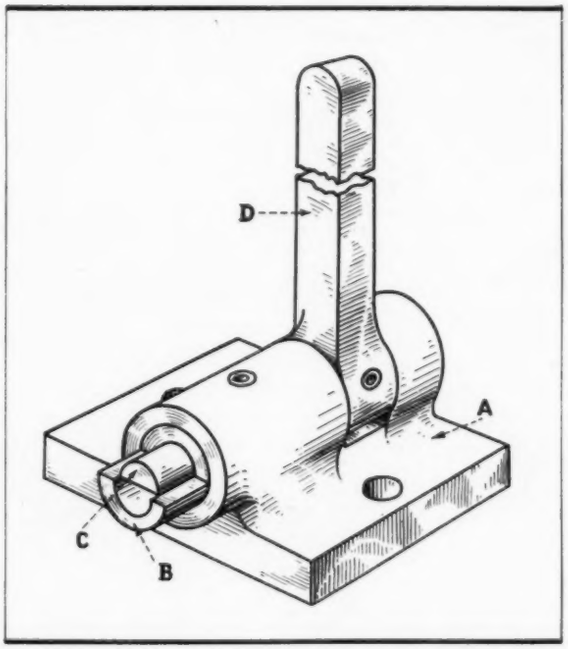
In the original arrangement the push broach had a tendency to go crooked, and in order to avoid rejection of parts, the designer called for a stock size at least $\frac{1}{8}$ in. larger than the finished outside diameter and allowed $\frac{3}{16}$ in. on the solid end for chucking the material. The part was turned down to size after the hole was broached. This procedure insured that the hole came out central with the sleeve.

With the hole broached all the way through an allowance of $\frac{1}{16}$ in. on the diameter is sufficient. The sleeve will be centered on inserts for turning after broaching.

Bench Shear Cuts Flat Material

BY L. KASPER

A bench shear which is suitable for cutting narrow, flat material is shown in the drawing. In addition to being powerful, it has the added advantages of having



This bench shear for cutting narrow, flat material has two sets of cutting edges

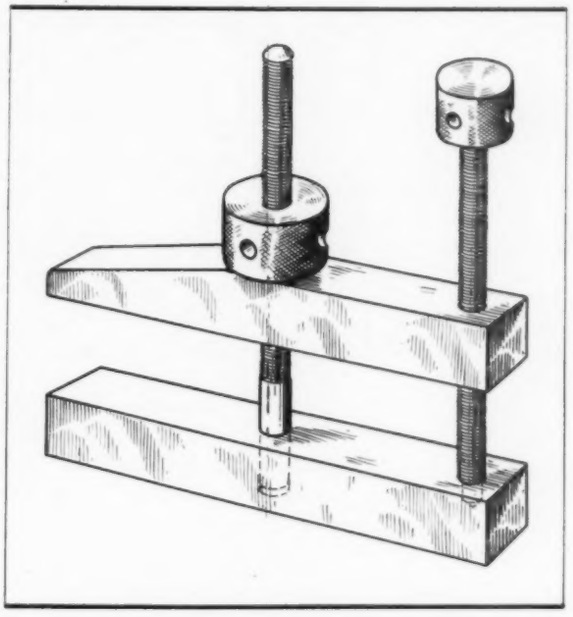
two sets of cutting edges, either of which may be used effectively, and when dull, may be sharpened in a few minutes.

Casting *A* is bored on one end to carry lower cutter *B*, which is of tubular section ground away on the protruding end. Part *B* is held in position by a setscrew and supports upper cutter *C* on one end. Part *C* passes through handle *D* which is attached to it by a setscrew, and through the rear bearing on the casting. Parts *B* and *C* are hardened on the working end and are ground to a close running fit. They are ground past their axial centers, to provide an opening for the material to be cut.

Work Clamp With Smooth Base

BY MARTIN H. BALL

The parallel clamp shown in the drawing can be used advantageously for many jobs where the ordinary parallel clamp with projecting screws on both sides will not fit. It is useful, for example, when two or



This work clamp has a smooth base parallel with the working surfaces

more bars can be clamped together, with a clamp at either end resting on the machine table.

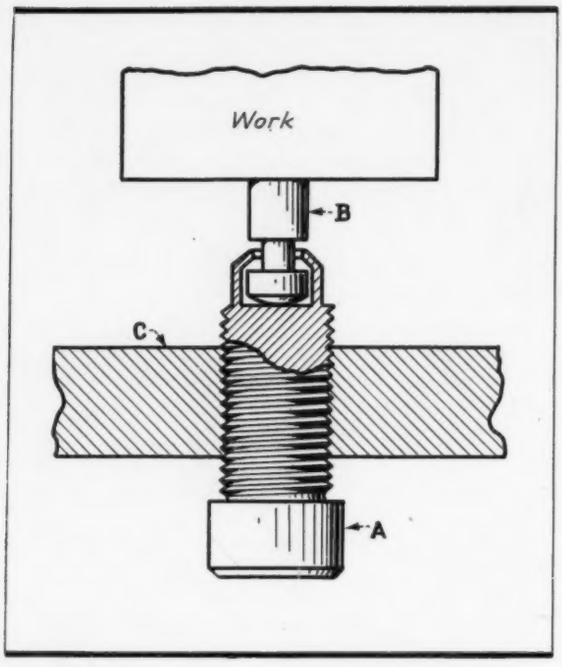
This clamp differs from the usual kind by having separate screw *A* secured to the base jaw, so that the clamping effect is produced by nut *B* bearing on the tapered jaw.

Nut *B* is made larger in diameter than end screw head *C*, so that it can generally be made tight enough by hand grip on the knurled surface. Pin holes are provided for clamping when necessary.

Clamping Screw for Finished Surfaces

BY EUGENE GROSZ

When a clamping screw in a jig or fixture has to bear against a finished surface and space is at a premium, the arrangement shown in the drawing has



When space is at a premium, a screw of this design is useful as a clamping point for holding work with a finished surface in a jig or fixture

been found useful. It is not bulky like the conventional clamping screw. The diameter of the button can actually be made smaller than the diameter of the screw.

Standard commercial screw *A* is turned on the end as shown in the drawing. Button *B* is made to fit the end of the screw. With the button in position, the turned end of the screw is spun over slightly into the groove in the button to hold it in place. Body *C* of the jig or fixture is drilled and tapped to fit the screw.

To Square Mixed Numbers

BY ALFRED G. WINTERS

Tables of square numbers found in books did not satisfy me that this was the easiest method, nor did they seem to contain all the numbers that were required. Therefore, I attempted to square numbers by the pencil method and developed the formulas below. A little study will show that many mixed numbers can be squared mentally by this method:

Square the whole number and square the fraction. Double the fraction and multiply by the whole number, then add all the results thus obtained. Example:

Square $7\frac{5}{8}$ $7^2 = 49$ $(\frac{5}{8})^2 = \frac{25}{64}$ $2 \times \frac{5}{8} = \frac{10}{8}$
$7 \times \frac{10}{8} = \frac{70}{8} = 8\frac{3}{4}$

Reduce to decimals 49.000
0.390
8.750
58.140

To square mixed numbers when the fraction is more than $\frac{1}{2}$ and the numbers in the fraction are large:

Increase the mixed number to a whole number and write that number minus the fraction that was added. Square the whole number and subtract the product of the fraction doubled and multiplied by the whole number. Then add the square of the fraction.

Example: $\left(7\frac{63}{64}\right)^2$ Change to $8 - \frac{1}{64}$

$8^2 = 64$
$8 \times \frac{2}{64} = \frac{1}{4} = 0.25$
$(\frac{1}{64})^2 = \frac{1}{4096} = 0.00025$
or $0.0156^2 = 0.00025$

64.00
−0.25
63.75
+0.00025
63.75025

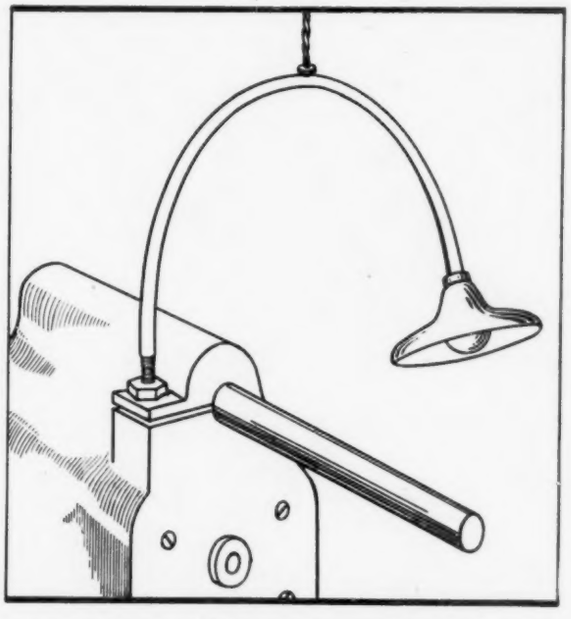
Conduit Provides Lamp Adjustment

BY GEORGE HOLMAN

A free swinging lamp can be brought into the proper position by an arrangement like that shown in the drawing, in circumstances when the light otherwise causes glare that makes accurate work difficult.

The locking capscrew is removed and replaced with a stud and nut, with the stud protruding 3 or 4 in. above the nut. A piece of conduit is bent into a semicircle and one end fitted over the stud. A hole is drilled in the conduit at the top of the curve and an insulator put in the hole to protect the cord. The cord enters through this hole and runs down through the conduit to the open end where a socket and shade are attached.

The lamp may be swung to any desired position in a full circle and will remain fixed at the point set.



To avoid glare which may be caused by a single free swinging lamp, a light may be attached to the end of a bent piece of conduit

Armament

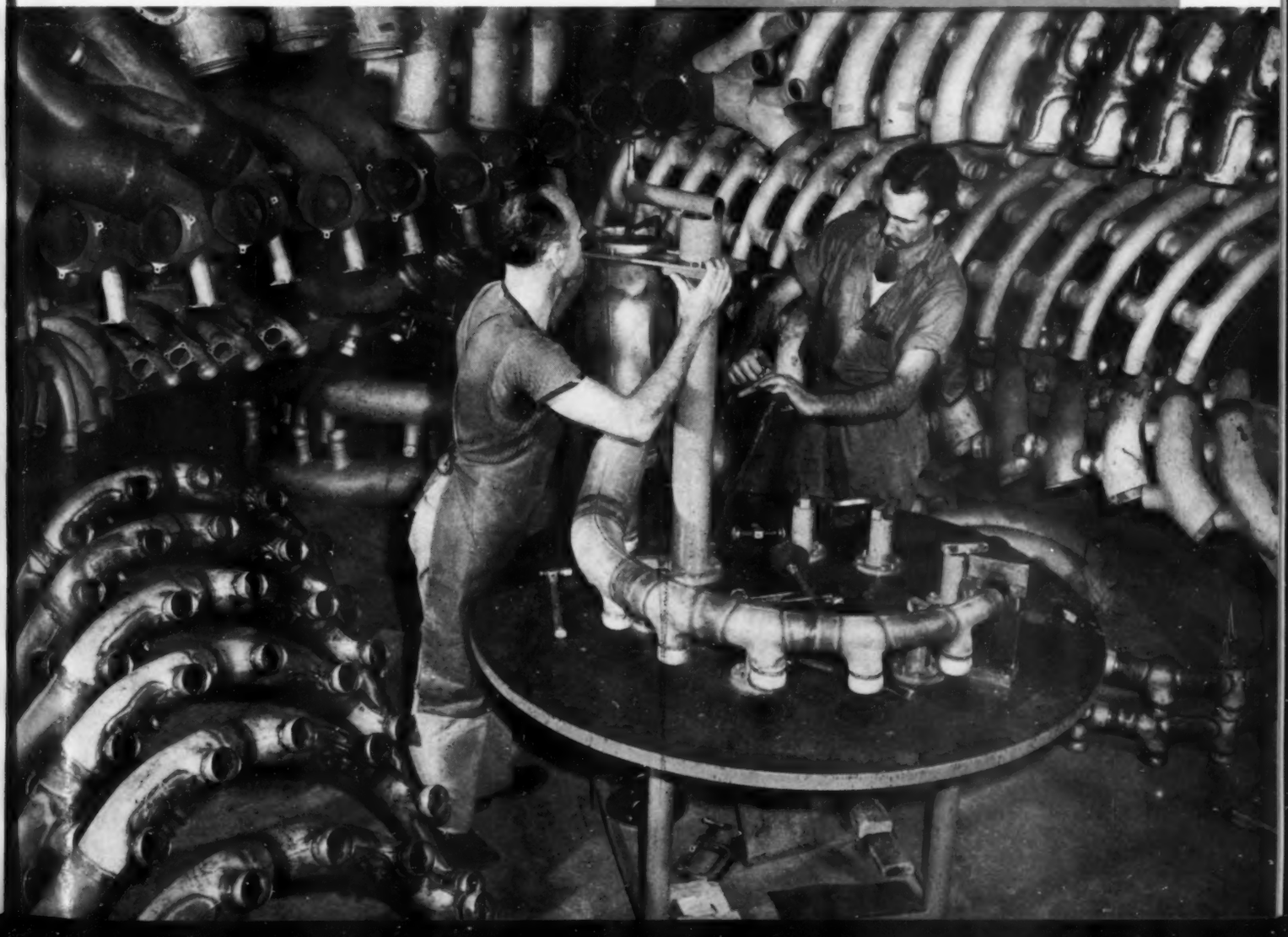
SECTION OF AMERICAN MACHINIST

Flow Production of Aircraft Manifolds

By ERNEST A. MOORE
Factory Superintendent, Ryan Aeronautical Company

This article has been reviewed and approved by the proper military authorities

IN SETTING UP for the manufacture of manifolds, a great many difficulties were experienced in the change from the job shop method to "flow production" methods. The system established prior to volume production depended to a large extent upon the individual initiative of the department heads as well as practices which were standardized in terms of personalities, rather than in terms of good production practices. The change involved nearly every phase of plant operation:- engineering, tool planning, production control, quality control and plant layout. The parts are carefully engineered for production and the tools are so planned that when the drawings are released to the loft for the master layout, the clamps, hanger parts, blanking dies for doublers and all the standard accessories, can be made ready for the



jig assembly. In the tooling department, the jigs are made in sections or subassemblies, to permit the men, when the jigs reach production to work around them with ease and convenience. More jigs are made of the difficult sections, in order that the sections that require more man-hours to complete, may be produced as rapidly as the sections that are not so complicated. In this manner it is not difficult to distribute the man-hours available so as to maintain a steady flow of parts in relationship to the schedule.

Coordination is solved by using the master templet to lay out all jigs. While the jigs are in their initial stages of construction the modeling department is constructing patterns. Completion of the patterns by the modeling shop permits the dies to be cast in the foundry. To facilitate the completeness of the work done in the modeling shop, a foundry is located immediately adjacent to it, and is under the general supervision of the modeling department head. The foundry has a complete drop hammer so that it can set up the dies it makes, clear them for metal thickness and actually stamp one or more parts before releasing them for production. This check has repaid for the added investment, because of the elimination of stampings containing errors; production begins immediately upon release of dies from this department.

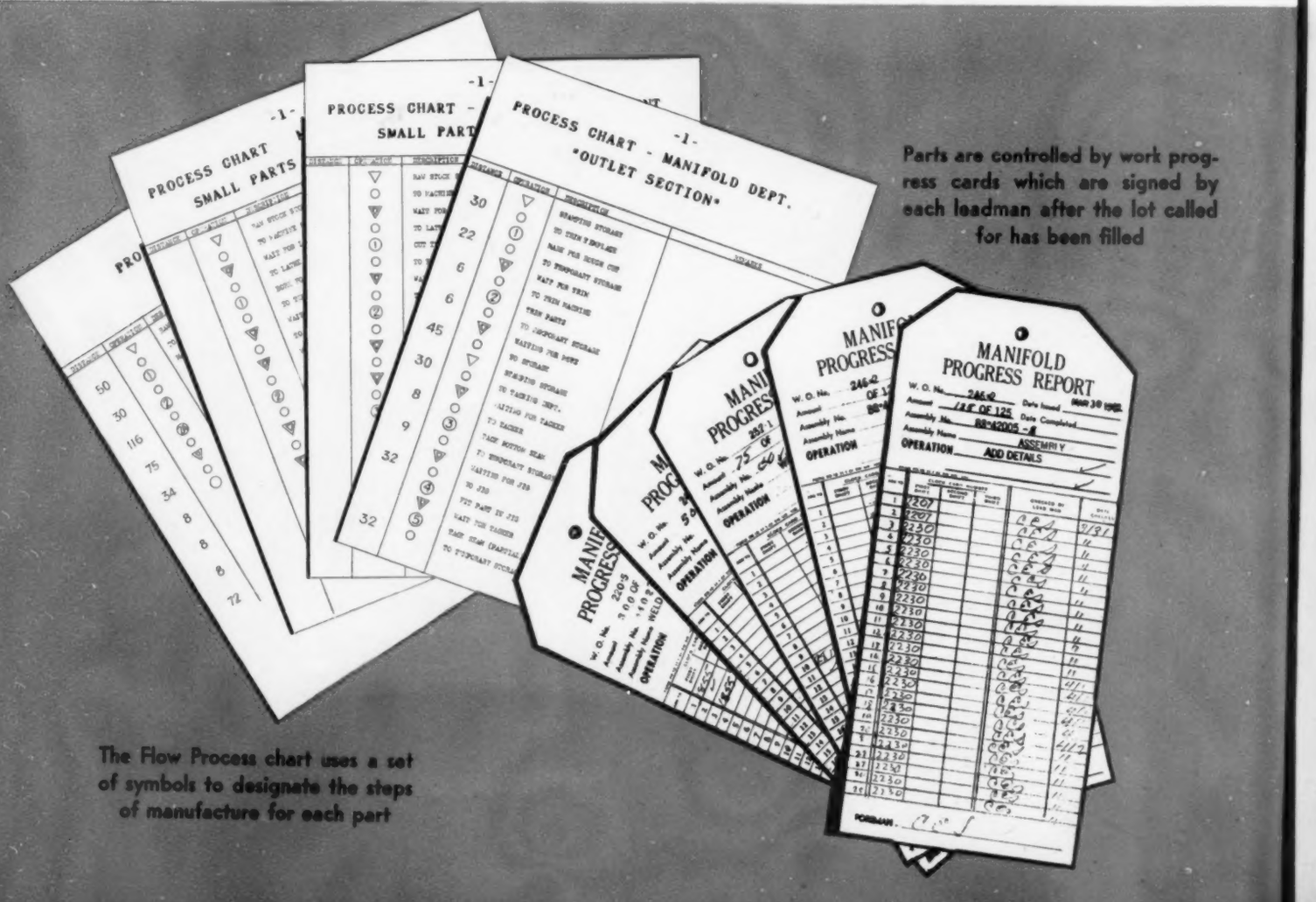
It was then necessary to revise the plant layout in order to coordinate these efforts. Parts for manifolds were formerly routed through the factory in the manner used for airplane parts. Such parts as flanges and analyzer bosses, and such operations as tube cutting and machining were formerly routed to the machine shop. Doublers, hangers and trimming operations were routed to the sheet metal department and tacking to the spot welding department.

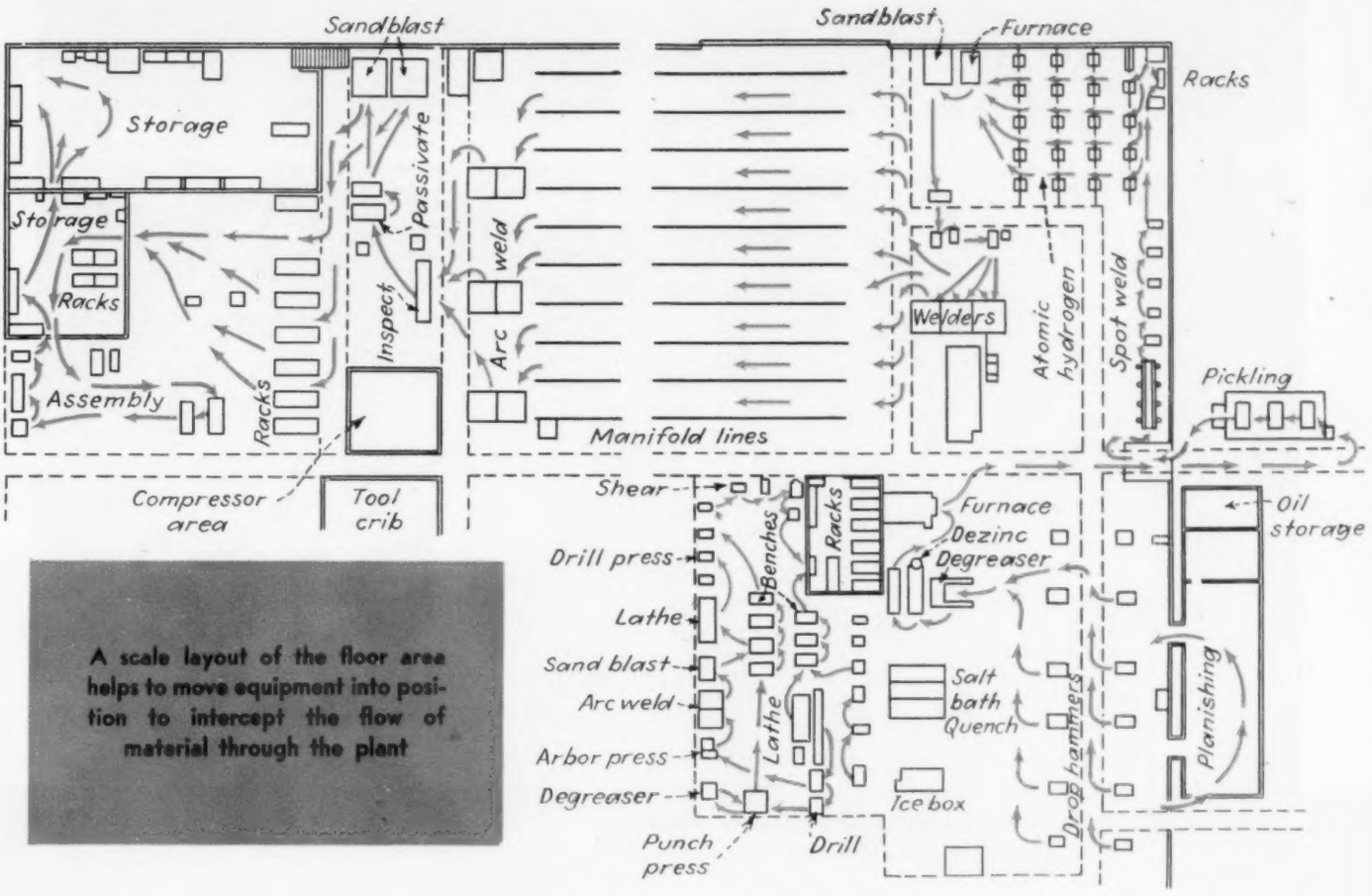
This obviously was not a satisfactory method of handling the extremely large volume of the parts which went into manifold making. It was found necessary to make a thorough study of manufacturing methods, as they existed at the time. This examination was conducted by means of a "flow process" chart made up as a case history in which a complete record of the part from its inception in the form of an engineering drawing to its completion as a finished part was kept in chronological order. This chart divided all operations, transportations, storages and inspections. These were designated for convenience by the following symbols:

Operations ○, Transportation ○,

Temporary Storage △, Inspection □

Lost time, lost parts, wasted energy and loss of


PROCESS CHART - MANIFOLD DEPT.
"OUTLET SECTION"
MANIFOLD PROGRESS REPORT
OPERATION
ADD DETAILS
Parts are controlled by work progress cards which are signed by each leadman after the lot called for has been filled
The Flow Process chart uses a set of symbols to designate the steps of manufacture for each part



A scale layout of the floor area helps to move equipment into position to intercept the flow of material through the plant

production on some of the items proved surprising. Errors were brought to light even though they had existed for long periods of time and were literally under the noses of the men in charge. The distance which the parts traveled was shown in a summary form on the bottom of the chart and in order to be of maximum value every movement of the part was carefully recorded. Unnecessary steps cannot be eliminated unless they are first brought to light and carefully examined. A flow process cannot be drawn in chart form while sitting at a desk. All of the parts must be followed through each operation, and no movement of the parts, however slight, nor any operation, however small, should be omitted from this analysis.

For convenience in visualizing the flow of a part, rough diagrams of the manufacturing space were made. These diagrams emphasized the existence of bottlenecks and back tracking. While these phenomena did appear in the summary of the flow process chart as excessive distances traveled, the existence of many parallel lines on the flow diagram brought them to light. It was not found necessary to make a flow process sheet for each piece or product because as one entire study was completed, it proved to be representative of many other parts and assemblies. One or two models usually account for the greatest volume of production. These were used as a guide and charted in detail, allowing the other models to conform to the general plan.

Every symbol on the chart can be questioned:

1. Can it be eliminated?
2. Can it be simplified?
3. Can it be combined?
4. Can the sequence be changed to advantage?

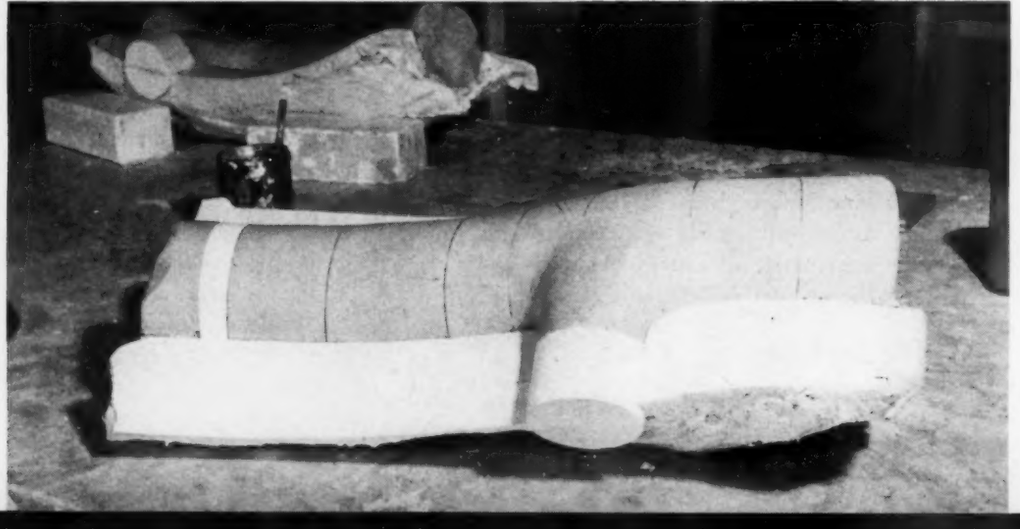
After the process chart had been carefully analyzed, it became a useful layout tool to develop conventional templet layouts of the manufacturing space available. On this manufacturing space layout, the various machines employed were moved into position, and jigs and fixtures relocated to intercept the flow as indicated on the flow process sheet. This resulted in distributing throughout the manufacturing space, the welding equipment, machine equipment and the assembly fixtures in their most convenient and natural locations.

It was found that production control methods established for airplane manufacturing were too complicated and cumbersome and not at all suitable for controlling flow in the manifold section. An extremely simple system was devised. The system now in use is a modified "block system" used with success in the garment industry. The manifold was con-

The flow production system is flexible enough to permit work on special jobs, to modify lots already in process or to change the manufacturing set-up without disturbing its operating efficiency

The molded ring is built up on a modeling board which represents the seam line

After a shell cast is taken from half the model, the other half is built on it with clay



sidered a suit of clothes in the sense that there is a general balance of parts and processes in the former as compared to a balance of pieces of cloth and the method of joining them in the latter. This is an excellent case for balanced flow production. Minor changes in the process at various points, as for example a different model, will permit a manifold to flow through the cutting, fabrication, assembly and lastly final inspection with little change in the balance of time requirements at each point. The production flow is controlled through control points established in a natural way along the lines of production.

Parts are stamped in large quantities, pickled and sent to permanent storage. From here on all work is controlled by work progress cards. These cards allow the work to progress through the system in predetermined lots. When the card is filled, it is signed off by the loadman of the group, who receives another card from the dispatch station together with any additional parts required.

Longer intervals are allowed between certain control points subject to interruptions or for delays in transportation. The parts just completed are passed along to the next station with a new control card and any additional parts required for that operation.

As each control point receives a work progress card, together with a block or lot of parts, it is entered on a graph in the dispatch station. Only one card is issued ahead of the schedule which prevents any operation from getting too far ahead and permits a much better distribution of manpower.

Flow production, unlike conveyor belt or continuous assembly, is extremely flexible and lends itself readily to the fabrication of manifolds. It may be added to, cut down or modified in any manner to meet special requirements, or special jobs without disturbing the over-all efficiency of the department.

Construction of aircraft exhaust manifolds must be such that the high temperatures encountered in service can be handled safely; that extremes in temperature from minus 50 to 1,600 F. can be withstood without harmful effects; that the pressures which must be maintained as part of a supercharger assembly

Blanks are cut from stainless steel sheets marked by templets nested together to reduce waste of material

be held so the maximum horsepower at high altitude will be developed; and that units deriving their source of heat from the exhaust system can be safe in their conduction of this heat either to air in the airplane cabin or to the intake air of the carburetor system. With engine horsepower as it is today, each cylinder often develops in excess of 100 hp., requiring that each pound or each ounce of metal be utilized to the maximum so light weight, resistance to corrosion, long life and safety can be maintained at all times.

Upon approval by the engineering division, manifold drawings are sent to the modeling shop, where a careful examination on the basis of production begins. Seam lines are located, and the most economical methods, both from the standpoint of material and production, are worked out.

As part of this work, a modeling board is made which represents the seam line. The molded ring is built upon this board by accurate steel templets; the latter is constructed sufficiently oversize to compensate for die shrinkage when the pattern is cast. Upon completion, a model which represents one half of the collector is produced. A shell cast is taken from the model, and the other half is constructed upon this with clay.

Then comes the construction of the final pattern and the casting of the die. Standard foundry methods are used for casting the dies, with care being exercised to insure the proper pouring temperature. The punch is poured directly into the die and the latter cleared to allow for the material thickness of the stampings. While this punch is still in the form of molten metal, mounting bolts are cast into it to meet with the holes in the drop hammer head.

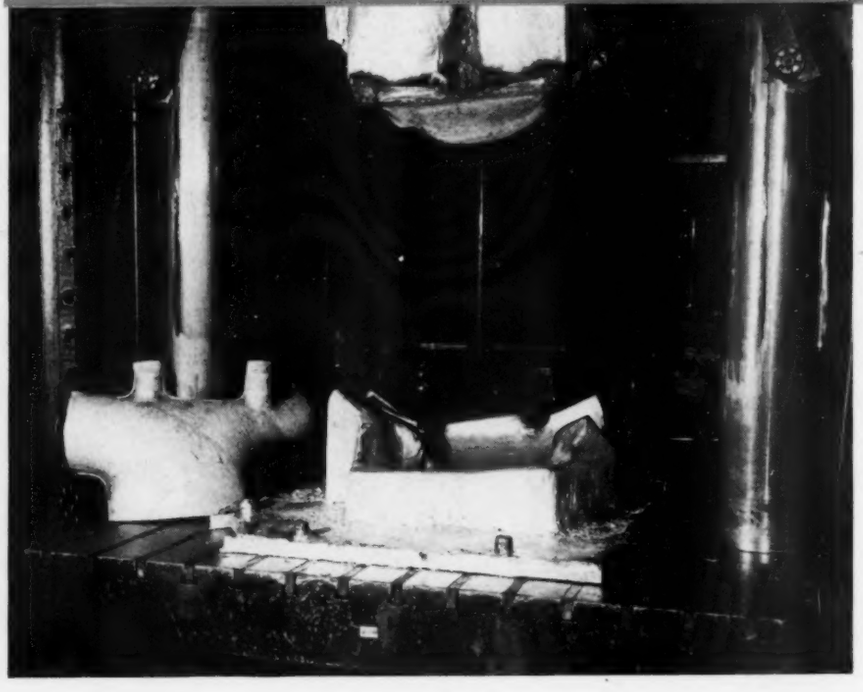
The next operation is stamping the parts. The blanks are marked for cutting by stencil. This consists of a network of templets fastened into a single sheet, carefully laid out to conserve as much material as possible. This pattern is then placed on the top of a stack of sheets and sprayed with a marking solution. After marking is completed, the material is sent to the cutting machines.

The drop hammer is still almost universally used for manifold stamping, although the punch press and sometimes the hydraulic press are used wherever the size and shape of the stamping permits. The drop hammer is not ordinarily considered a production tool; however with proper regard for die design, motion economy, mechanical handling and careful training of the operator, it lends itself to volume production.

Prior to the volume production use of stainless steel by the aircraft manufacturer in making exhaust collectors, most stainless steel was used for such articles as kitchen ware, dairy and food-handling equipment, and by the oil industry. A large amount of this material was subsequently buffed and polished. It, therefore, behooved the manufacturer to request a smoothly finished sheet to minimize later buffing and polishing.

Unfortunately this material worked a hardship on the exhaust collector fabricator, in that the extreme smoothness of the sheet generally shortened the stamping life of the metal, requiring undue annealing and excessive scrap losses. It furthermore made stamping difficult because the dies were unable to grasp the metal firmly, and as stamping progressed, uniform deformation of the metal would not result. The surface of material used today is slightly roughened by a

The rope drop hammer still holds its own as the chief means of forming manifold parts



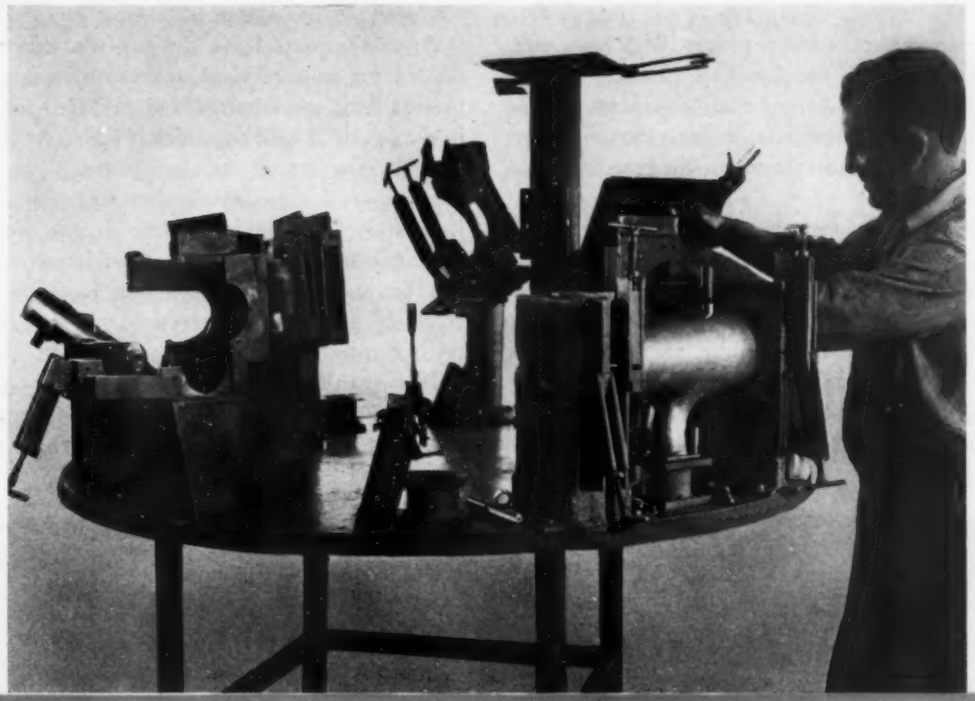
Annealed manifold parts are placed in an acid-resisting basket in which they are pickled and spray cleaned

After cleaning and inspection parts are tack welded together along the seams

By means of a special nibbling machine, the flash is trimmed off close to the spot welds

Atomic hydrogen welding increases output and leaves a ductile weld

Seam welding is followed by a furnace anneal for stress relief



Special jigs are used to hold universal joint type manifolds while welding in order to maintain close limits

finish pickling operation in the steel mills. A modification of the basic 18–8 formula gives an increase in ductility and greater work hardening before thinning out and rupture occurs.

Drop hammer stampings, upon completion, are loaded on a conveyor and sent through a degreasing unit for cleaning. Upon removal from the degreaser, the parts are sent to a nitric acid tank where they are treated for the removal of foreign metallic particles that might have been picked up from the dies in the stamping process or previous mechanical working. This is essential since stainless steel possesses the property of galling readily with tools and dies. Surface alloying sets up galvanic couples, which produce bright colored rust spots in a short period of time.

The stampings are rinsed in hot water following removal from the nitric acid tank and conveyed directly to the annealing furnace, where the parts are annealed at a temperature of 1950 F. The time of soaking is usually short, from 3 to 5 min. No quench is required since the material is so thin that air quenching is adequate.

Upon cooling, the parts are placed on an acid-resisting basket which carries them through the pickling process. For careful control and improved quantity, a two-stage operation further possesses the advantage that little or none of the base material is attacked by the acid. The basket is then lowered into a spray cabinet where water from high pressure jets thoroughly scrubs off all remaining traces of scale.

As they leave the spray cabinet, the parts are placed on a conveyor belt and inspected. This eliminates unnecessary stacking and piling and permits re-routing rejected stampings so the continuous production line is in no way interrupted by quantities of parts requiring additional work. Accepted parts are conveyed to the tacking department. Here mating parts are fastened together with quck-acting clamps and spot welded together at the seam. A special technique is employed in tacking to allow for flash trimming to proper flange height and further to prevent any unnecessary defect when the welding is later completed. The flash is trimmed by the use of a nibbler shear designed for this operation.

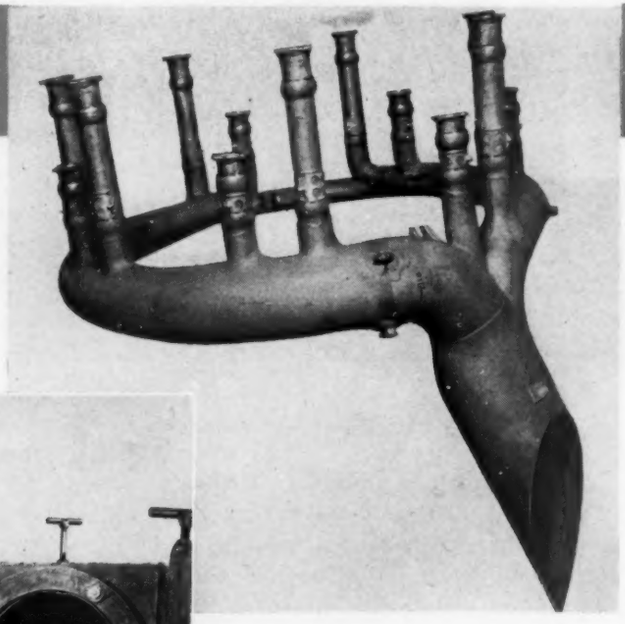
As the parts arrive in the welding department, they are welded along the tacked seam by the atomic hydrogen welding process. This process is comparatively new in the aircraft industry and possesses several advantages. Chief among these are a great increase in the number of inches of weld per minute, a weld sufficiently ductile to permit considerable forming, should this be necessary in later line-ups, and a

complete absence of carbon pickup with resultant hardening of the weld metal. This method has been modified by the Ryan Aeronautical Company to permit welding stainless steel parts without the use of any flux whatsoever either on the top or the bottom of the seam.

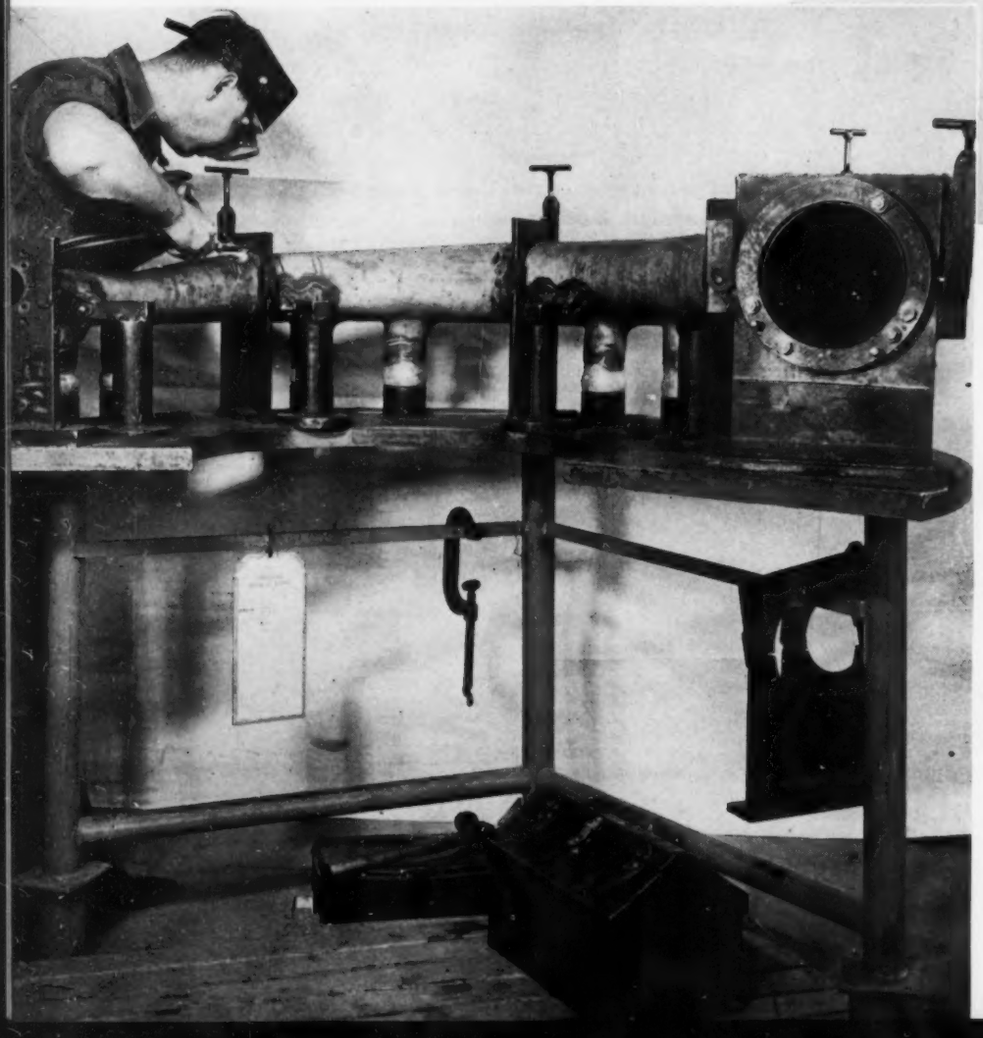
Extreme care has been practiced to investigate all phases of the welding process in order that a sound, defect-free and ductile weld may always be made. After seam welding has been completed, the parts are stress relieved by furnace annealing, thereby preventing any possibility of failure in the critical area adjacent to the weld as well as modifying the grain structure in the weld metal itself.

After the parts leave the furnace, they are sandblasted for scale removal, marked by means of overpressed templets, trimmed and prepared for assembly in the jig. All welding which is added from this time on is by the use of the electric arc. The chief advantage of this method is that more rapid welding is possible resulting in a more ductile weld; slight misalignments so often encountered in weld assemblies can be easily adjusted without resulting in weld cracking and severe distortion, thus reducing the rework required.

In a manifold of the universal joint type, where the unit sections are large, the limits imposed are severe and special jigs are required which allow for



The Ryan exhaust manifold equipped with ball on socket joints absorbs vibration but requires precision manufacture



In assembling universal joint manifolds the jigs are designed to allow for distortion

the distortion following welding. The chief feature of these jigs is the method of holding the parts to be welded. The parts must be held rigidly, yet at the same time permit movement without undue stress on the welds.

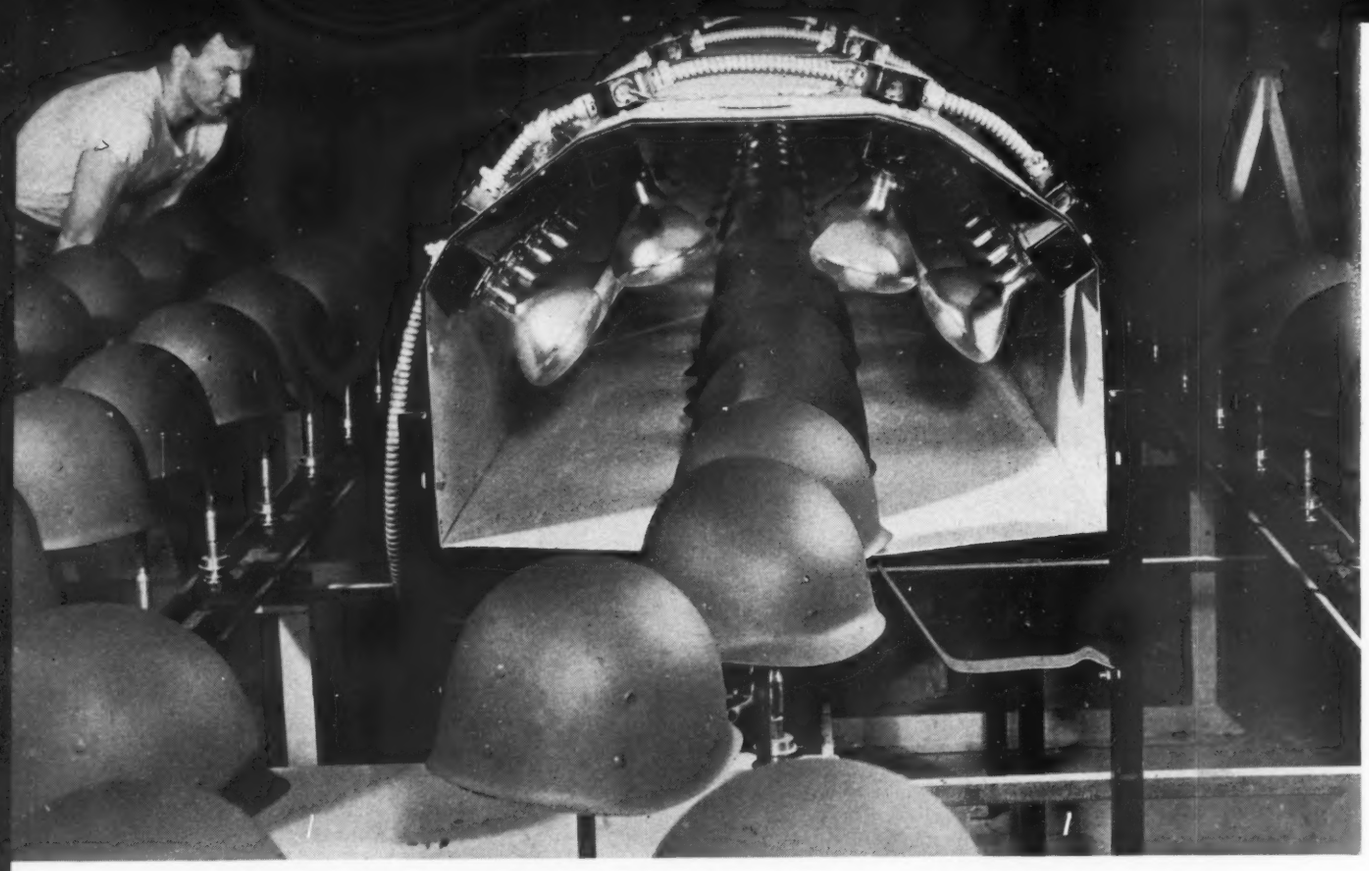
These jigs are not made according to engineering drawings, but are designed to allow the shrinkage that occurs in welding to draw or warp the parts into their correct position. The main body of the manifold ring is fitted into special brackets which, while permitting the required degree of movement, still control the direction of such movement. Supplementary welding jigs incorporate the same feature.

The problem of controlling distortion during welding, has been solved by the process of trial and error with the result that after long experience it has been possible to arrive at the required allowances between the jigs used for assembly and the jigs used for final checking.

After assembly in the assembly jig and before checking on the inspection jigs, the entire unit is sandblasted. After inspection and before shipping, the completed manifold is passivated to increase the corrosion resistance of the metal. This treatment consists of immersing the parts in hot nitric acid so that a tightly adherent and impervious oxide film is developed in the surface of the metal, completely eliminating the possibility of corrosion under normal conditions.

(Presented May 8, 1942 before the Southern California Section of the Society of Automotive and Aeronautical Engineers.)

Before shipping all manifolds are carefully checked by company and customer inspectors



Spaced 15 in. apart, plastic liners for Army helmets are dried at the rate of 500 an hour.

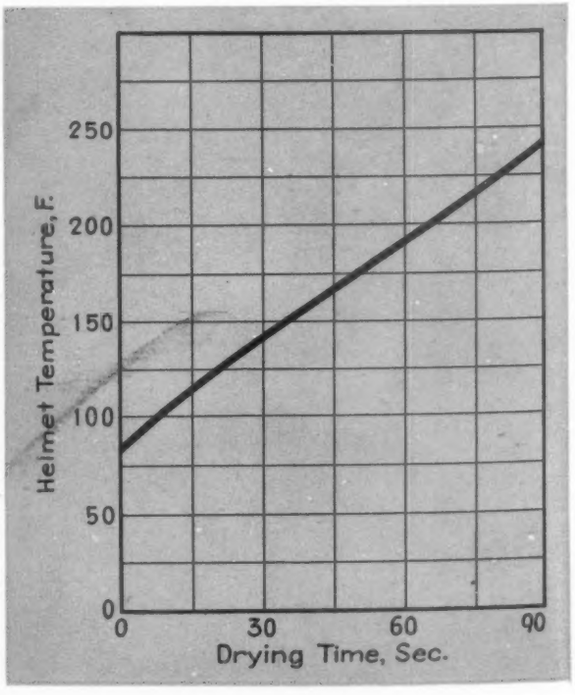
Radiant Heat Dries Helmet Liners

INFRA-RED DRYING of freshly painted Micarta liners for army helmets, compared to the oven method, has speeded this operation 1,000 percent and has reduced dryer installation cost from $2,500 to $600, according to H. C. Guhl, Micarta development supervisor, Westinghouse Electric and Manufacturing Company. In addition, the rapid drying is not of sufficient duration to enbrittle the plastic and cause rejects.

The oven method of drying would have required a tunnel-shaped unit 225 ft. long and an estimated drying time of 15 min. The infra-red dryer installed is 19 ft. long and dries the liners in 95 sec.

The helmets are painted while on a conveyor which passes through the dryer at a speed of 12 ft. per min. To obtain even drying at 240 F., the liners are rotated slowly on spindles as they move under four rows of 250-watt R-40 infra-red lamps with built-in reflectors. The rows, each having 28 lamps, are spaced 8½ in. apart under an arc-shaped hood of such curvature that the lamps are 4½ in. from the liners with the rays at right angles to the painted surfaces. Power consumption to operate the 112 lamps on a 110-volt line is 28 kw.

After the helmets leave the dryer, they continue on the conveyor for 7 min., are inspected and packed.



This curve shows the relation of helmet temperature to drying time as the helmets pass beneath banks of infra-red lamps

Recommended Tap Drill Sizes—IV

SIZES OF TAP DRILLS, AMERICAN NATIONAL FINE-THREAD SERIES

Size of thread	Threads per inch	Minor diameter of nut			Stock drills corresponding to 100 percent to 50 percent of basic thread depth		
		Basic	Maximum	Minimum	Nominal size	Diameter	Percent of depth of basic thread
8	36	0.1279	0.1402	0.1339	*0.1285*	*0.1285*	*98*
					0.1299	*0.1299*	*95*
					0.1339	0.1339	83
					0.1360	0.1360	78
					0.1378	0.1378	73
					0.1406	0.1406	65
					0.1440	*0.1440*	*55*
10	32	0.1494	0.1624	0.1562	*0.1520*	*0.1520*	*94*
					0.1562	0.1562	83
					0.1610	0.1610	71
					0.1660	0.1660	59
					0.1695	*0.1695*	*50*
12	28	0.1696	0.1835	0.1773	*0.1719*	*0.1719*	*95*
					0.1730	*0.1730*	*93*
					0.1770	*0.1770*	*84*
					0.1800	0.1800	78
					0.1850	0.1850	67
					0.1875	0.1875	61
					0.1910	*0.1910*	*54*
1/4	28	0.2036	0.2173	0.2113	*0.2090*	*0.2090*	*88*
					0.2130	0.2130	80
					0.2187	*0.2187*	*67*
					0.2244	*0.2244*	*55*
5/16	24	0.2584	0.2739	0.2674	*0.2610*	*0.2610*	*95*
					0.2656	*0.2656*	*87*
					0.2720	0.2720	75
					0.2770	*0.2770*	*66*
					0.2812	*0.2812*	*58*
					0.2854	*0.2854*	*50*
3/8	24	0.3209	0.3364	0.3299	*0.3230*	*0.3230*	*96*
					0.3281	*0.3281*	*87*
					0.3320	0.3320	79
					0.3390	*0.3390*	*67*
					0.3437	*0.3437*	*58*
7/16	20	0.3725	0.3906	0.3834	*0.3750*	*0.3750*	*96*
					0.3860	0.3860	79
					0.3906	0.3906	72
					0.3970	*0.3970*	*62*
1/2	20	0.4350	0.4531	0.4459	*0.4375*	*0.4375*	*96*
					0.4531	0.4531	72
9/16	18	0.4903	0.5100	0.5024	*0.5000*	*0.5000*	*87*
					0.5062	0.5062	78
					13 mm	*0.5118*	*70*
					33/64	*0.5156*	*65*
5/8	18	0.5528	0.5725	0.5649	*9/16*	*0.5625*	*87*
					14.5 mm	0.5709	75
					37/64	*0.5781*	*65*
3/4	16	0.6688	0.6903	0.6823	*17 mm*	*0.6693*	*99*
					43/64	*0.6719*	*96*
					11/16	0.6875	77
					17.5 mm	0.6890	75
					45/64	*0.7031*	*58*
					18 mm	*0.7087*	*51*
7/8	14	0.7822	0.8062	0.7977	*20 mm*	*0.7874*	*94*
					51/64	*0.7969*	*84*
					20.5 mm	*0.8071*	*73*
					13/16	*0.8125*	*67*
					21 mm	*0.8268*	*52*
					53/64	*0.8281*	*51*
1	14	0.9072	0.9312	0.9227	*59/64*	*0.9219*	*84*
					23.5 mm	0.9252	81
					15/16	*0.9375*	*67*
					24 mm	*0.9449*	*59*
					61/64	*0.9531*	*51*
1 1/8	12	1.0167	1.0438	1.0348	*26 mm*	*1.0236*	*94*
					1 1/32	*1.0312*	*87*
					26.5 mm	1.0433	75
					1 3/64	*1.0469*	*72*
					1 1/16	*1.0625*	*58*
					27 mm	*1.0630*	*57*
1 1/4	12	1.1417	1.1688	1.1598	*29 mm*	*1.1417*	*100*
					1 5/32	*1.1562*	*87*
					29.5 mm	1.1614	82
					1 11/64	*1.1719*	*72*
					30 mm	*1.1811*	*64*
					1 3/16	*1.1875*	*58*
1 3/8	12	1.2667	1.2938	1.2848	*32.5 mm*	*1.2795*	*88*
					1 9/32	*1.2812*	*87*
					1 19/64	*1.2969*	*72*
					33 mm	*1.2992*	*70*
					1 5/16	*1.3125*	*58*
					33.5 mm	*1.3189*	*52*
1 1/2	12	1.3917	1.4188	1.4098	*35.5 mm*	*1.3976*	*95*
					1 13/32	*1.4062*	*87*
					36 mm	1.4173	76
					1 27/64	*1.4219*	*72*
					36.5 mm	*1.4370*	*58*
					1 7/16	*1.4375*	*58*

STARRETT TOOLS

Checking a landing gear section with a Starrett Dial Test Indicator.

Using a Starrett Vernier Height Gage to check a jig in an aircraft plant toolroom.

It takes ZEROS *to beat* ZEROS

That's why Starrett Micrometers, Starrett Vernier Gages, Starrett Dial Indicators and hundreds of other Starrett Precision Tools are in the very thick of this fight.

Every man and woman in the Starrett organization is conscious of the importance of Starrett accuracy to the war effort and is doing the utmost to provide the tools and to put them in hands that count most heavily on the side of victory.

In meeting this objective your mill supply distributor is likewise contributing invaluable cooperation and service. We're back of him to the limit of our ability. Rely on him on all matters pertaining to procurement of essential precision tools.

THE L. S. STARRETT CO • ATHOL • MASSACHUSETTS • U. S. A.

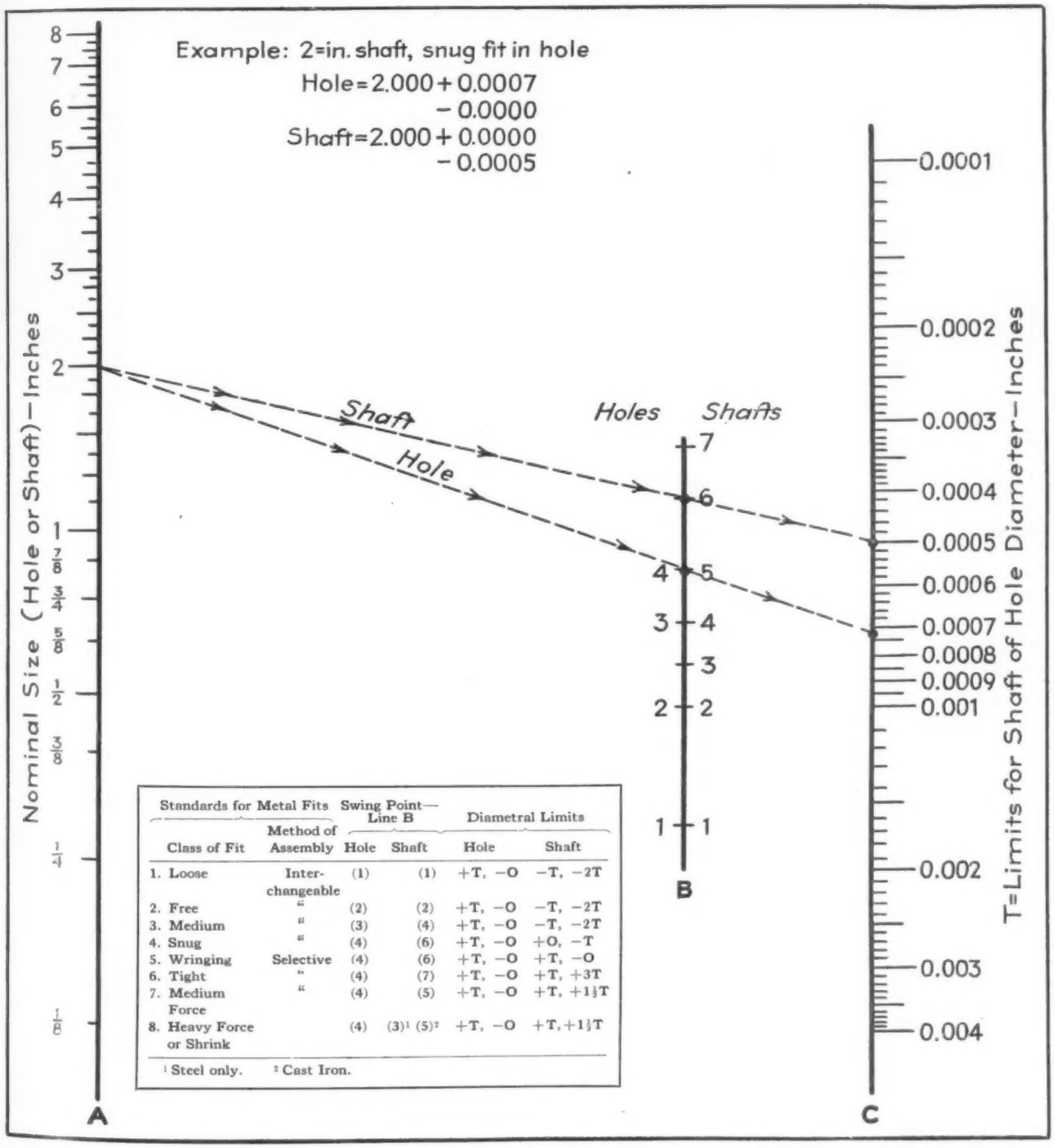
World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Allowances for Shaft Fits

BY R. P. VALTIER

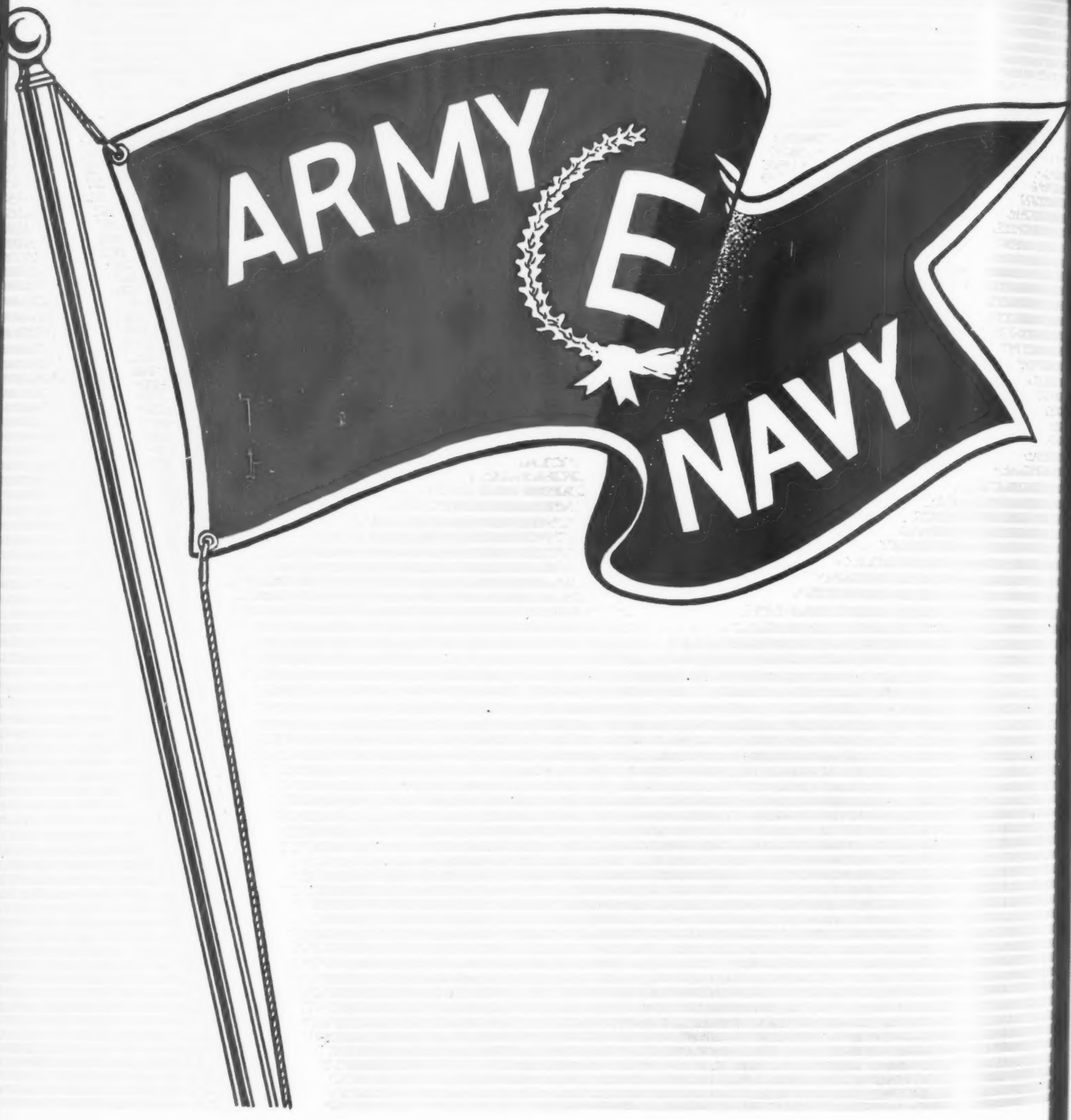


Standards for Metal Fits		Swing Point—Line B		Diametral Limits	
Class of Fit	Method of Assembly	Hole	Shaft	Hole	Shaft
1. Loose	Interchangeable	(1)	(1)	+T, −O	−T, −2T
2. Free	"	(2)	(2)	+T, −O	−T, −2T
3. Medium	"	(3)	(4)	+T, −O	−T, −2T
4. Snug	"	(4)	(6)	+T, −O	+O, −T
5. Wringing	Selective	(4)	(6)	+T, −O	+T, −O
6. Tight	"	(4)	(7)	+T, −O	+T, +3T
7. Medium Force	"	(4)	(5)	+T, −O	+T, +1½T
8. Heavy Force or Shrink		(4)	(3)[1] (5)[2]	+T, −O	+T, +1½T

[1] Steel only. [2] Cast Iron.

To use chart:

1. Find size of hole or shaft on line *A*.
2. Find swing point on line *B* for proper fit. Note hole fits are on the left-hand side, shaft fits on the right-hand side.
3. Lay straight edge across these two points to locate point on line *C*.
4. Determine diametral limits from reading on line *C* and values given in above table.



★ **THE NEW BRITAIN MACHINE COMPANY has been honored**

BY RECEIVING

THE ARMY-NAVY PRODUCTION AWARD

CONFERRED FOR HIGH ACHIEVEMENT IN THE PRODUCTION OF WAR EQUIPMENT

. . . . . THIS AWARD WILL SPUR US ALL TO GREATER EFFORT . . . . .

THE NEW BRITAIN MACHINE COMPANY

NEW BRITAIN, CONN.

A Job Well Done

THIS HAS BEEN a war of surprises.

Few of us expected France to be a pushover. After Dunkirk most people felt that Britain had small chance of holding out against the Nazis, but she did.

Even the military experts gave Russia little chance against Hitler, but Soviet forces still are in the field today and are fighting magnificently.

Most Americans would have said in advance that Pearl Harbor could never have happened. But it did. And the Japanese swept through the South Pacific with unanticipated speed.

Neither Hitler nor his lieutenants believed America could make herself felt in time to win this war. We were too unprepared, industrially and militarily.

But even Hitler is in for a surprise, just as other surprises have occurred regularly and disconcertingly since September, 1939.

That surprise will come in the form of weapons of war pouring out of American factories into the hands of the soldiers and sailors and airmen of the United Nations.

Hitler believed it couldn't be done in time. He thought American mass production too ponderous to be shifted quickly from manufacture of radios and automobiles to guns and aircraft and tanks.

But it is being done. Though we have made grievous errors and on occasion have seemed all thumbs in our war efforts, the strides made the past two years, and more especially in recent months, have been tremendous.

Armament today is being produced in amazing volume, considering the brief time we have been at the task. One reason why we are face to face with a materials shortage is because production of many kinds of war goods is so far ahead of schedule.

Industry has demonstrated its ability to turn out products at a rate limited only by the materials and manpower available.

In this practical demonstration of America's industrial might, scores of war industries have participated—machine tool builders, small tool and gage makers, aviation and automobile manufacturers, to mention only a few.

The managements of these companies have completely abandoned regular operations to devote their energies, night and day, to giving the armed forces what they need and to providing necessary equipment to war factories.

The employees in turn have worked long hours, many of them on night shifts, to get the war job done. They have been faithful, conscientious and patriotic. They have been as eager as the men in the Solomons or in Egypt or in Iceland to do their part in contributing to a decisive victory over the Axis.

It is most appropriate, therefore, that the Army and Navy have singled out the companies which have given exceptionally meritorious service and awarded them the "E" pennant. The "E" flag floating over an American factory, plus the "E" pins worn by workers, signifies a job well done.

Burnham Finney

GAGING BUSINESS

Huge shipments of raw materials to Allies one cause of shortages. Machine tool production declined in August, after July rise. Backlog is reported still growing

Shipments of huge quantities of raw materials to our allies have been more responsible for current shortages of supplies for war factories than is generally realized. Censorship prevents the mention of specific figures, but manufacturers themselves are surprisingly unaware of the large percentage of the materials in certain lines that has been and still is going out of the country. So long as this situation continues, and it promises to go on indefinitely, it will be exceedingly difficult for shortages here to be overcome.

Output To Go Down—The lack of sufficient materials will compel downward revision of production schedules in some war goods. Curtailment will be applied first to many products which have gone ahead of current needs. In certain instances production may temporarily be halted entirely, as partial operations are impractical. Pressure will be used to step up production in other lines in which output is behind immediate requirements.

Balancing Production—This method is being employed to bring production into better balance, as Donald Nelson indicated was necessary. Subcontracting will be important in the stepping-up process. There is neither time nor materials for building increased capacity. The new policy by which production of war goods will be brought into balance comes as no surprise. The surprise is that it did not happen sooner. The reasons for the proposed drastic action are two-fold: the unexpectedly large volume of exports of raw and semi-finished materials, and far greater output in hundreds of war factories than seemed possible.

Tool Demand Heavy—The shortage of materials, particularly steel, has diverted attention from the fact that war contractors do not yet have all the machine tools needed for their tooling programs. In some cases the contractors are having their schedules set back by inability to get machine tools because machine tool builders are having trouble securing materials to maintain production at peak capacity. The tightest situations are in certain classes of steel, anti-friction bearings and motors, particularly the first two.

Fight For Materials—In the recent realignment of preference ratings, machine tool builders did not receive as high ratings as they previously had possessed. Approximately 50 percent of their requirements were put in the double A classifications and the remaining 50 percent in A-1-a. Some betterment has been made the past week. The new set-up calls for 30 percent to be in the AA-1 classification, 25 percent in AA-2-x, 30 percent in AA-3, 10 percent in AA-4 and 5 percent in A-1-a. In the opinion of machine tool builders, the A-1-a rating is practically worthless. The value of the other ratings is such that the industry can be assured of only 30 percent of its requirements and will have to stand in line and fight for the other 70 percent.

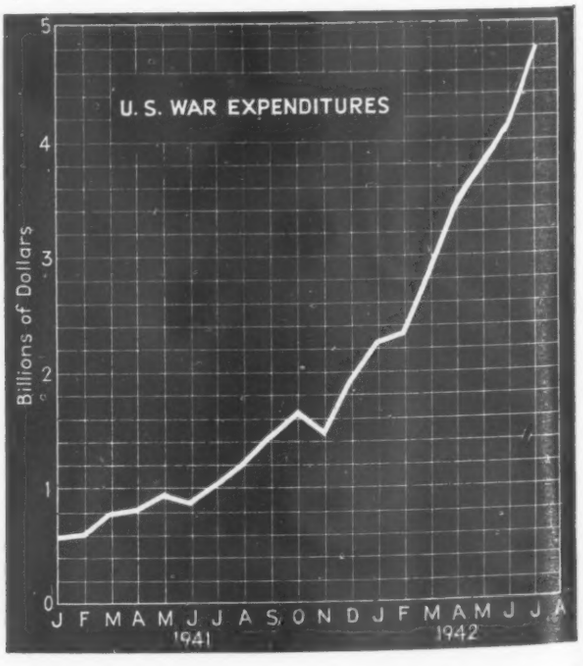
Services to Blame—They do not lay the blame for this condition in the lap of the War Production Board. Instead they feel that the unbalance in distribution of materials has resulted largely from the indiscriminate issuance of preference ratings by contracting officers of the Army and Navy. Donald Nelson, during the past week, put a stop to this practice by taking away from the Services the authority to issue any such ratings.

Dip Probably Small—Machine tool production in July topped the performance in June by a small margin. The tightness of materials, however, brought a decline in August, though the falling off is believed to have been less than anticipated. Production for the next month or two may be adversely affected by materials shortages. Machine tool builders are vexed by the fact that they may not be able to push their industry's output to a new high point because of lack of materials, though just now new plant capacity is becoming available for the first time. The new capacity has been created specifically at the request of the Federal Government.

Tremendous Backlog—The failure of many war contractors to get steel and other materials has brought about a considerable number of cancellations of machine tool orders. Despite this, the backlog of the industry is reported close to $1,500,000,000, which represents more than a full year's output at present unprecedented levels and is three times the volume on last Jan. 1. In fact, orders still are coming in at a rate in excess of current production, despite the widespread belief that the industry is over the hump.

Business Not Well Divided—But this huge business is far from being evenly divided among members of the industry. In certain critical tools, companies have orders to keep them busy for 12 to 18 months. In other cases builders are seeking orders for the immediate future. These builders are doing subcontract work for the over-burdened manufacturers. The Army and Navy are understood to be dead set against converting any machine tool plants, or any portion of any single plant, to the production of ordnance items at this time. Even if some machine tool builders may not be fully occupied at the moment, the services are afraid that some new demand for machine tools may arise from a war emergency and find a certain amount of machine tool building capacity out of commission.

Another Peak—A sharp increase in the rate of expenditures for war purposes was recorded again in July. A preliminary report shows them to be $4,794,000,000 as compared with $4,123,000,000 in June. This was a gain of 16.3 percent and was largely accounted for by War Department figures.



May Revise PRP to Stop Priority Inflation

Priority control has become a problem of scheduling. WPB determined to stop priority inflation before October 1, fourth quarter applications will be scaled down to supply

BY ROBERT COLBORN

WASHINGTON—The management of "priorities" has become, in the last few months, an essentially different kind of job from what it used to be. Until the war industries became capable of absorbing all and more of the available goods, the details of the priority set-up had little actual effect on production. It was only necessary to put red stickers on war business so that it would get handled ahead of civilian work. Now the job is to see that goods get where they are wanted when they are wanted. The word, actually, is "scheduling."

The Production Requirements Plan, use of which became compulsory in the quarter-year beginning July 1, is the first attempt to attack this new job.

Actually, in the third quarter, PRP has been just a bookkeeping fiction. Everybody went through the motions of filling out and processing PD-25As. But the practical effect was nil. Trouble was that PRP was made universal at the last moment. WPB didn't have the time or the staff to do the key job of balancing requirements against supply.

Consequently, in the third quarter, the total of rated requirements still exceeds the supply of materials, and the inflation of priority ratings proceeds unabated.

Among the Alternatives

An effect of the mix-up has been to bring forward a variety of proposed alternatives to PRP. The most prominent of these is the so-called Contract Production Control—a scheme which is being pushed by the Army and Navy and has gained a little support inside WPB. Support for it arises in part from a recognition of PRP's major weakness—the absence of any real check on manufacturers' estimates of their requirements; in part from premature despair over PRP's poor initial showing; in part from a desire by some Army and Navy officials to discredit WPB handling of materials.

Basis of CPC is that an Army and Navy contractor, at the time of receiving a contract would submit a statement of the materials he needs to carry it out. If the contractor purchases any semi-fabricated items or sub-assemblies he would obtain a similar bill of materials from his suppliers, who would likewise obtain material schedules from their sub-suppliers, and so on down the line. All these separate material bills would be coalesced by the prime contractor into a single document to be submitted to the procurement agency.

Then permission would be granted to purchase that quantity of materials.

This scheme has progressed far enough that a set of forms for handling it has been designed. And Nelson has approved a test of its mechanics in connection with contracts for "walkie-talkie" radios.

CPC, however, is given little chance of ever displacing PRP as the major control mechanism. Unquestionably many of the features of CPC will show up in the gradual evolution of PRP.

Stopping Priority Inflation

The next stage in that evolution is the preparation of the fourth-quarter allotments. Fourth-quarter applications under PRP were due Aug. 10, and most of them were received. Processing of these applications, now underway, has one over-riding objective—to scale down requirements to match supply. Priorities officials are determined that after Oct. 1 the inflation of priority ratings shall stop.

It's recognized that this scaling down will in many cases be brutal and disruptive—a matter of swinging a cleaver in a dark room. Firms which have deliberately inflated their requirements estimates will profit (unless the Industry Branch guesses what's up). Some essential jobs are going to find themselves in trouble. WPB people, nevertheless, are trusting to a rapid procedure for making adjustments from a reserve pool and are going to bull the thing through. At least, they believe, in the fourth quarter a priority rating will get you the stuff.

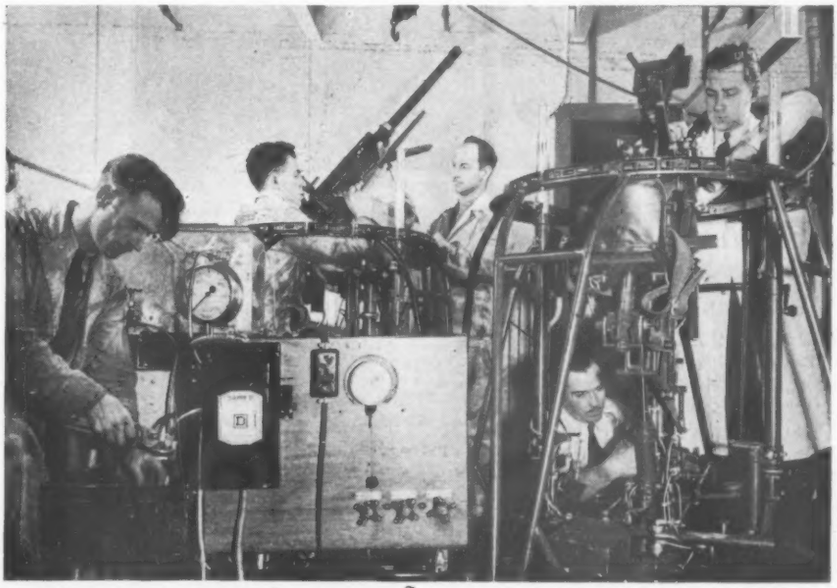
No one is under any illusions that this fourth-quarter procedure will provide the complete planned economy that's needed. No bookkeeper's tricks with requirement estimates can do more than clean up the obvious bad spots unless the estimates themselves have some realistic basis.

Intelligent Scheduling

Top WPB attention, therefore, is now directed behind the estimates that come in from industry. The job to be done falls into two parts. One is the scheduling of prime contracts by the procurement agencies. The other is the intelligent and economical scheduling of purchases by contractors and their suppliers.

The first is essentially a job for the procurement agencies themselves. What's called for is a little more respect for the concept of a delivery date. Inevitably, in the past, delivery dates have usually represented simply the procurement officer's idea of the quickest the job could be done.

Close scheduling of sub-contracts and work in the plant is equally essential. Here the ultimate perspective is that every major plant will have a resident WPB representative taking a daily hand in work scheduling just as it now has resident procurement inspectors.



Death in the Making—Turret assemblies for Canada's Bolingbroke bombers have their Browning machine guns mounted on a pivoting seat-and-gun unit which gives the gunner an almost unlimited range of fire

First Presentations of Army-Navy "E" Made As 96 More Pennant Winners Are Announced

NEW YORK—The engineer from the local radio station, eyes glued to his watch, raised his arm slowly, held it there an instant, and then brought it down in a swift signal. The company band played the *Star Spangled Banner*. The mayor stepped to the microphone and with practised skill delivered his brief remarks of welcome. The colonel sitting on the chairman's right then rose and in his crisp, military fashion presented the burgee to the plant. As the president accepted it, workers sitting in the front row could see a suspicious gleam in the corner of his eye; could feel a catch in their own throats as the pennant caught the breeze and floated upward in the slanting rays of the late-afternoon sun.

Thus, with slight variations, did the new Army-Navy Production Award come to many an industrial plant last week. In Washington it was announced that two new groups of plants had been selected to receive the award, bringing the total since the three earlier awards were combined to 172.

A few highlights from various ceremonies are shown in the pictures on these pages. The morale-building value of the ceremonies is undeniable and in these plants men have returned to their work with renewed energy and fuller understanding of their importance as production soldiers.

To some observers, however, of equal or greater significance in view of the heavy criticism that has recently been leveled at our production program, was the fact that men of such integrity as compose the awards committee (*AM*—Vol. 86, page 916d) could—after studying production figures to which the general public and press could not possibly have access—turn to 172 war production plants and justly say, "Well done."

The following companies in the metalworking field were among those in the fourth and fifth groups selected to receive the award:

Aetna-Standard Engineering Co., Chas. G. Allen Co., American Tool Works Co., Autocar Co., Bendix Aviation Corp., Blanchard Machine Co., Briggs & Stratton Corp., Cambridge Screw Co., Chain Belt Co., Chevrolet Motor Car Co., Cincinnati Bickford Tool Co., Cummings Machine Wks., Cushman Chuck Co., Duplex Printing Press Co.

Ex-Cell-O Corp., Federal Screw Works (Plant No. 4), Fosdick Machine Tool Co., General Machinery Corp., General Motors Corp. (A C Spark Plug Div., Delco Products Div., Guide Lamp Div.), Giddings & Lewis Machine Tool Co., Greenlee Bros. & Co., Hanson-Whitney Machine Co., Harrisburg Steel Corp., Heald Machine Co.

Kearney & Trecker Corp., Landis Machine Co. (M52 fuse plant), Lapointe Machine Co., R. K. LeBlond Machine Co., Leland-Gifford Co., Lincoln Engineering Co., Lundquist Tool & Mfg. Co., Marchant Calculating Machine Co., Micromatic Home Corp., Miller Printing Machinery Co., Murray Mfg. Co.

National Automatic Tool Co., National Pneumatic Co., National Twist Drill & Tool Co., Omaha Steel Wks., Otis Elevator Co., Putnam Tool Co., R.C.A. Mfg. Co. (Radiotron Div.), Reed-Prentice Corp., Remington Arms Co. (Bridgeport, Denver plants), Rivett Lathe & Grinder, Inc., Robertshaw Thermostat Co., William Sellers & Co., Sheffield Corp., Star Electric Motor Co., Stewart-Warner Corp. (south plant), Struthers Wells-Tutusville.

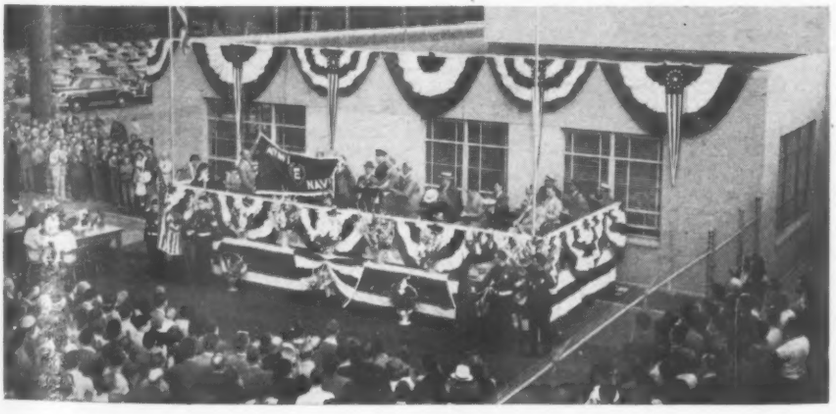
Timken-Detroit Axle Co. (Detroit, Waukeegan, Oshkosh plants), Towmotor Co., United Engineering & Foundry Co. (105 mm. Howitzer plant), United Shoe Machinery Corp., Universal Boring Machine Co., Vilter Mfg. Co., Western Cartridge Co., Williams Oil-O-Matic Heating Corp., Wright Mach. Co.

THE FELLOWS GEAR SHAPER CO. received the award in the first of three ceremonies which were held consecutively at Springfield, Vt. E. W. Miller, general manager of the firm, is seen addressing the employees. Governor Wills of Vermont and U. S. Senators Austin and Aiken were among the guests. The ceremony was concluded with a community sing led by the company band

GREENFIELD TAP AND DIE CORP. employees heard Major Paul Houser tell them that the pennant was a "military decoration given on the field of battle." Left to right are Major Houser; John H. Haigis, master of ceremonies, Donald G. Millar, president; Patrick Sullivan, employee with 53 years service; and Thomas Collins, employee with 55 years service

JONES & LAMSON MACHINE CO. and **VERMONT FOUNDRIES** were honored in a joint ceremony so that four awards were made in the three ceremonies held in Springfield on August 24, the first time any town has been so honored. Ralph E. Flanders, president of Jones & Lamson, accepted the awards for both firms. John E. Lovely, vice president, was master of ceremonies

PRATT & WHITNEY DIVISION Niles-Bement-Pond Co. dedicated two new buildings at the same time the award was received. Clayton R. Burt (speaking), president and general manager, said that "tough problems have been met and solved." Lt. Gen. Knudsen made the presentation and accepted the dedication of the Knudsen Building and the MacArthur Building



BRYANT CHUCKING GRINDER CO. received the award in the third of the Springfield ceremonies. J. B. Johnson, general manager, was chairman of the ceremony and W. J. Bryant, executive vice president, accepted it for the company. Senator Austin said that "we shall persist in the work of devising the new tools for the new uses. This is your victory"

SIMMONS MACHINE TOOL CORP. was the first company in the rebuilding field to win the honor. Charles A. Simmons, Sr. (second from left in first row), president, told workers that "you have made it possible for discarded machine tools to function efficiently in this war." Captain Almy (speaking) said that repair and conversion of used tools is of paramount importance

THE GLEASON WORKS received the Army-Navy Production Award in a ceremony at a Rochester Theater. James E. Gleason, president, is shown receiving the pennant from Colonel Frank J. Atwood, chief of the Rochester Ordnance District. In the background are E. Blakeney Gleason, vice-president and treasurer, who presided, and Commander Francis J. Cleary

BOEING AIRCRAFT COMPANY was cited in a ceremony at which thousands of workers were present (above).

JOSHUA HENDY IRON WORKS received the Maritime "M" for their production of marine engines. Inspecting the plant (right) are Admiral H. L. Vickery, vice chairman of the Maritime Commission; Carl Flesher, West Coast Director of Construction for the Commission; Charles E. Moore, president, and Felix Kahn, vice-president

Machine Tool Balances Are Reallocated in E-1-b Change

WASHINGTON — Unordered balances of machine tools have been reallocated under a new amendment to the War Production Board's Preference Order E-1-b. The amendment takes effect in December.

The original order, effective last May 1, provided that where one group of Service purchasers failed to take its full quota, the unordered balance should be scheduled for other Service purchasers in accordance with their urgency standing ratings on the Master Preference List.

The amendment changes this ruling so that where a producer has surplus tools because one group has failed to order its quota, these tools go to the group of Service purchasers which has the largest backlog of orders on the producer's books in proportion to the number of tools to which the group is entitled under its quota.

The following example is offered by the Board to show what it means: "Suppose Group A is entitled to 25 tools per month under its quota and after scheduling this number for delivery to Group A members, a producer still has on his books unfilled orders with required delivery dates in the month in question or in preceding months, for 50 tools. Suppose further that Group B is entitled to only 5 tools and that the producer has a similar backlog from this group for 20 tools. Group B is suffering more than Group A because the backlog of group B is 4 times its quota, whereas the backlog of Group A is only twice its quota."

The effect of the amendment will be to equalize this situation. If a producer has surplus machines they will be scheduled for Group B purchasers until their backlog is reduced to the same ratio as that of the backlog for Group A.

In the situation cited above, if a producer has 5 surplus tools, he schedules them all for Group B purchasers, who get 10 tools in that particular month. The fact that purchasers from other groups may later place orders, even though they may be higher on the Master Preference List, does not alter the allocation of 10 tools to Group B.

The amendment does not affect schedules for August, September, October, or November, but takes effect in December.

Service Purchasers, who get 75 percent of the output of machine tool producers by types and sizes, include the Navy Bureau of Ships, Navy Bureau of Ordnance, Army Ordnance, Army and Navy air services, Miscellaneous Bureaus and Branches, and the Maritime Commission.

A.S.T.E. Meeting To Study War Production Problems

DETROIT—The two-day War Production Conference of the American Society of Tool Engineers scheduled to be held at the Kimball Hotel, Springfield, Mass., on October 16 and 17 will stress the production problems which have arisen during the first nine months of the war, and plans to solve the threatened bottlenecks in war industry caused by shortages of critical materials among other problems.

Five important sessions will be held during the conference, opening with one on emergency training, followed by a session on inspection Friday afternoon and a discussion on tool conservation and salvage in the evening.

Conversion to war production and war tooling will be discussed at the morning session on Saturday, while a presentation and forum on material substitution has been planned for the afternoon conference.

Frank W. Curtis, chief engineer of Van Norman Machine Tool Co., Milling Machine, Div., and past president of the society, will be chairman of the conference, with the New England and Middle Atlantic states chapters acting as hosts.

INSIDE DETROIT

Detroit adheres to planned schedules but falls below potential production because of machinery and material shortages. Combat-Automotive Center set up by Ordnance Department

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Some pertinent facts and observations have been brought to light concerning the automobile industry's war effort since a national magazine charged Detroit—symbol of the industry—with slackness in a sensational article.

An over-all view of the situation is this: the automobile industry so far has managed to stay upon a planned schedule of output that is now soaring into uncharted regions, and would be doing an even better job were it not for the lack of machinery and materials.

Munitions production in August, as reported by the Automotive Council for War Production, was running at $13,600,000 per day. Expressed in annual rate, this is equivalent to $5 billion, or 20 percent above the peacetime peak. Deliveries soared from $172,734,000 in January to $413,712,000 in July.

The goals for the automotive industry are: an annual production rate of $8 billion by January, $12 billion by mid-1943. It is significant that if the annual production rates achieved each month since Pearl Harbor are plotted, and the curve extended to the above goals, the output month by month will be seen as moving steadily on schedule toward those goals.

General Motors output of munitions in U. S. and Canadian plants doubled in the January-July period, moving from $78,048,424 to $156,982,348. July's production was practically equivalent to fourth-quarter 1941 output of $158,469,698, and was 10 percent above the June figure. Altogether, the corporation produced $785,331,500 worth of munitions in the first seven months of 1942. Employment in U. S. plants stood at 234,031 in the week ended August 16, up 16,051 from a month earlier.

Behind Current Potential

So much for the record of being on schedule. What is interfering with above-schedule production? According to one of the best informed top executives in the industry, whose name is withheld: "The automobile industry is today producing only 60 percent of its *current potential* in war goods because of a lack of machinery and materials." His view would be substantiated by other plant managers.

Contract by contract, this source traced how the brakes have been put on certain phases of his company's war production by political maneuvering, the necessity to deal with $200-a-month clerks raised to important government positions, conflicts of interest among government agencies, diversion of raw materials from the machine-tool industry and the tendency remaining among military engineers to insist upon hundreds of detail changes which interfere with putting even a small batch into production.

These examples can not be detailed adequately without revealing military information. Suffice it to say that two important ordnance items are not yet in production although three months overdue. One plant has nearly 1,000 new machine tools standing idle. Refusal to grant a few additional machines needed to start a pilot line was bluntly made on the basis that a couple of small companies not very far along on similar programs should get first choice of equipment for political reasons.

Autumn Difficulties

It is a question whether the automotive industry as a whole can maintain acceleration of munitions production on schedule this fall by reason of insufficient machinery and especially machinery that is not tooled. The Army's procurement policies created a bonanza rush for machine tools and tooling through: (1) an edict that all equipment needed in 1942 be ordered as of April 1, and (2) the exceptionally short periods allowed contractors to get into production—three months in some instances.

The glut of work that descended upon the machine-tool industry has been relieved to some extent by a flood of cancellations. There being no time to process jobs properly, master mechanics played safe—very safe in some cases. Now they find that those extra machines are not needed. As a consequence some producers are able to say that they are over the hump on building some classes of critical machines, delivery schedules have been stepped up, modest stocks of some sizes have been accumulated.

Tool and Fixture Work

But fixture and tool work is another story. Designing and building time is sold out so far ahead, that one prominent Ohio builder is asking customers to get their own fixtures and tools made. Some of this work has been thrown into Detroit. The trouble here is that the major plants have most of the better independent job shops loaded with work. So there is a prospect that bare machines will be standing idle for extended periods on armament-plant floors.

Armament production being what it is, the machinery pool established by the Automotive Council for War Production has not been able to distribute an extremely large number of idle automotive machines. As of a recent date approximately 9,000 machine tools had been moved from their peacetime location—either to other plants within a corporation, to sub-contractors or to outside plants. The Detroit region of WPB has been able to move about 1,200 machine tools. In many instances, these two sources have made it possible for munitions makers to get into produc-

VANIMAN HEADS AUTO BRANCH

WASHINGTON—R. L. Vaniman of Detroit has been appointed Chief of the Automotive Branch of the War Production Board, according to A. I. Henderson, Deputy Director General for Industry Operations. He succeeds Ernest Kanzler who was recently appointed Deputy Chairman for Program Progress of the War Production Board. Mr. Vaniman was formerly executive manager of the African Division of Chrysler Corp. and has recently been Kanzler's assistant.

Scrap Haul — A roundup of scrap and obsolete machinery at the plant of L. O. Koven & Brother produced no less than 579,770 pounds of metal for the nation-wide scrap drive

tion, but have not been very helpful to concerns needing long lists of machines, because in the aggregate the requirements have been far apart from the specifications of existing items.

Combat-Automotive Center

In recognition of the part played by Detroit in manufacturing military vehicles, a Combat-Automotive Center has been set up here to "direct the design, procurement, supply and maintenance of all Army vehicles and tanks." Col. A. R. Glancy, deputy chief of the Ordnance Department, and former president of Pontiac, heads up the Center, which has taken over the Union Guardian Bldg. and six floors of the Fisher Bldg. Total employment—officers, technicians and others may reach 8,500 persons, with up to 3,500 to be transferred from Washington and St. Louis. The Center will allocate the business to the thirteen Ordnance districts; the actual contracts will be placed by the Ordnance offices in respective districts.

The Army has also placed contracts with 41 manufacturers for 880,000 trucks over an undisclosed period. In some local plants, the existing production rates will not be bumped up. Emphasis apparently is upon the procurement of heavy trucks, such as have been desired by the British. These 6x6 jobs will throw new strains upon the manufacture of axles, transfer cases and front wheel drives. One plant alone must set up to make 200,000 axles for this size of truck, equivalent in production requirements to 600,000 axles for 4x4 trucks. In some respects, the program is deemed "fantastic" by experienced truck producers, not only in the extra material, tires and material required, but the production and machinery problems involved.

Scrap Committee

A labor advisory committee is to be set up this week in Washington to assist the scrap program. UAW officers met last week with Donald Nelson and other WPB officials, as well as AFL representatives to discuss plans by which the national unions can take part in the program. Until now, UAW local unions have participated, but the national union has not taken part in the scrap drive. Immediate problem is to equalize banks of scrap at the mills, and to lay more effective plans for getting in the scrap—industrial and from public sources—in the next three months. The UAW has suggested that an overall committee be created to take responsibility for the scrap program, inasmuch as WPB sources admitted that data on collections are incomplete and many agencies are now working independently on the scrap problem.

It may be that scrap collection in the Detroit area is accelerating although the absence of complete reports prevents a factual conclusion. May collections of all materials from reporting industrial concerns were 89 million lb.; June, 140 million lb.; July, 192 million lb. In each month the number of concerns reporting varied widely. Furthermore, there was no exact method of determining how much of this material again appears in the reports of scrap merchants.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ALUMINUM—A combination conservation and use-control order restricts some less essential military uses and insures adequate supplies for combat items in revoking of Orders M-1-e and M-1-f. (Supplementary Order M-1-i.)

ALUMINUM SCRAP—Issuance of a complete revision of price schedule to cover all secondary aluminum ingot and practically all grades of this scrap has been made. (Revised Price Schedule No. 2.)

BRASS—Ceiling action has been taken which reduces weighted average selling price of brass and bronze alloy ingots about 1.20 cents per lb. below March, 1942 level. (Maximum Price Regulation 202.)

FABRICATED STEEL — Formula for determining maximum prices for structural shapes, plates and bars and service of fabricating these products when such prices cannot be established under section 2 has been announced. (Maximum Price Regulation Order 61, section 3 (b).)

GAGES—Special gages manufactured pursuant to customer's drawings have been placed on a March, 1942 base date. (Amendment 3, Maximum Price Regulation 136.)

INDUSTRIAL TRUCKS—A list is now available of approved standard models which manufacturers will be permitted to produce. (Supplementary Limitation Order L-112-A.)

KITCHENWARE — Further reduction in the use of iron and steel in manufacture of kitchen utensils and household articles has been made. (Amendment 6, Limitation Order L-30.)

MACHINE TOOLS—Provision has been made for reallocation of tools after certain quotas have been filled to divide deliveries between service and other class purchasers. (Amendment 1, Preference Order E-1-b.)

PRIORITIES—New procedures for applying high preference ratings have been adopted. (Amendment 4, Priorities Regulation 1.)

THERMOPLASTICS—Changed to a limitations order and date for scheduling has been extended until October 1 pending revision of control. (Amendment 2, Preference Order M-154.)

TUNGSTEN—Ores or concentrates may be delivered by any producer, dealer or processor to dealers or processors for purpose of being concentrated or beneficiated without specific WPB authorization. (Amendment 1, Preference Order M-29.)

USED MACHINERY—Inventory is being taken by OPA of every piece of second-hand machinery held for sale.

7000 Working on Buildings For Chrysler Engine Plant

CHICAGO—Seven thousand men are now working two shifts upon Chrysler's $165 million Dodge Chicago Plant which will build a high-output radial engine in large volume for several aircraft uses. More than 97 percent of the many buildings involved are now underway. Combined floorspace of all structures will be nearly twice as great as Willow Run.

Machining practices will duplicate those employed by an Eastern manufacturer in order to save time in getting into production. Chief difference will be that even minor parts will be completely tooled. As additional models go into production, the parts will be processed on equipment lines now being installed, with perhaps the addition of a few machines here and there. This practice will permit more than 45,000 unskilled men to be employed, without need to make new setups constantly and to avoid the problem of training the large group of setup men that would otherwise be needed.

The plant will produce castings and forgings as well as handle all machining and testing. W. J. O'Neil, president of Dodge, is general manager of the plant; L. L. Colbert, operating manager; W. R. Gerber, formerly Dodge toolroom superintendent, is general works manager; F. J. Morisette, formerly Chrysler staff master mechanic and gun arsenal operating manager, is general master mechanic.

New Basis For Steel Quotas

WASHINGTON—WPB is preparing a revision of its steel quota assignment system for more equitable distribution among war equipment manufacturers and to equalize demand and supply.

Supply will be on a quarterly basis, among Army, Navy, Lend-Lease, Board of Economic Warfare, Maritime Commission, and civilian supply. WPB will get daily summaries of authorized purchases.

It is believed that purchasers will be divided into two classes. Class I would consist of purchasers who identify their steel needs with specific war contracts, and Class II would be those who apply for general requirements.

WARTIME WASHINGTON

Kaiser continues to get the Washington brush-off, but is getting growing support from some experts. Nelson tells how production in July advanced beyond the June levels

BY BLAINE STUBBLEFIELD

WASHINGTON—Henry J. Kaiser, with his proposal to build 5,000 large cargo planes per year in nine shipyards, has been getting the Washington brush-off.

Such is Kaiser's reputation for production miracles that no official has the hardihood to tell him publicly or privately: It can't be done. So they shunt him around.

For Kaiser is the modern Horatio Alger boy who says it can be done, and the people are in no mood for can't.

Army, Navy and WPB keep combing Kaiser out of their hair, but he crawls right back in again.

First they gave him, instead of the letter of intent he expected, a letter with Nelson's name on it, which told him to go ahead and hunt for materials not already ear-marked for existing war production schedules, and draw up some plans.

He found at least some materials not already corraled, and he produced the plans. Then they told him to check his ideas with plane manufacturers.

It was supposed that these experienced men would tell Kaiser some of the "plane" facts of life, which would discourage him.

Kaiser's Possible Headaches

And with good reason, according to the private opinion of aviation engineers. The auto industry is a sort of second cousin to airplane production, yet it is having horrible headaches trying to catch onto the stresses and fine tolerances of airplane building. Much less do Kaiser's dams, ships and cement mills pose these problems. If ship jointures are off an inch, they can be pulled together.

The high stresses in airframes, the fine accuracy necessary in wing jigs to preserve the airfoil design, the cumulative effect of error due to the size and shape of an airplane, all are Latin and Greek to ordinary engineers. Thus, undoubtedly, the airplane builders warned Mr. Kaiser that he was getting into a mighty tough field of miracle working.

But not all of them told him that. The taciturn Howard Hughes, millionaire tool builder, round-the-world-flyer, and developer of the Lockheed 4-engine transport "Constellation," popped up as a partner of Kaiser. And in Washington, Admirals Emory S. Land and Howard L. Vickery, chiefs of the great merchan ship program which is ahead of schedule partly because Kaiser pulled Liberty ship keel-to-delivery time down to about 40 days—both say he's got something.

But they, too, are shipbuilders; and Mr. Hughes is regarded by the aircraft industry as an eccentric, although all admit that he gets results and keeps his wits about him.

It is one thing to build big cargo planes—out of steel or wood—but quite another to build engines for them. Currently-produced airplanes are standing un-delivered for lack of engines. No shortcuts, no expedients, can be followed in engine building.

Mr. Kaiser says he will build them if Detroit doesn't, and to prove it he points to reciprocating steam plants he produced for his Liberty ships. But there is no comparison. It is such enthusiasms that bring down the scorn of conservatives upon Mr. Kaiser's head.

WPB had to appoint a special committee to evaluate the Kaiser cargo plane proposal. Kaiser's appeal direct through the press, over the heads of officialdom, brought great pressure on WPB to do something. Then, when the Board bounced him to the airplane builders and he bounced back with Howard Hughes under his arm, it was too much, and the committee was the result.

Committee members Martin and Loening are outspoken heavy-cargo fans, and Douglas and Northrop are favorable. The Committee says it will "do everything in its power" to help Kaiser, but "without interference with the present or prospective military program." This adds up to no commitment at all.

Most trustworthy authorities privately believe Kaiser will fail this time, but they, and Washington in general, are glad to see such a show of confident enterprise.

July Production Figures

Donald Nelson's figures on July production, released late last month, showed that July figures were in every case cited above June. But they were a little disingenuous. They failed to disclose that the July-June increases in many items merely brought output back up to the May peaks.

July production of aircraft was 11 percent ahead of June, though the increase was concentrated in transports and trainers rather than in combat types, which only rose 6 percent. It is now admitted that plane production will not rise significantly for several months. The last figure made public on total production was the May output of 4,000 aircraft.

A major element in the failure of plane production to rise is a renewed shortage of engines. Engine and airframe production are in a constant race.

The present difficulties with engines are mostly in shortages of high-alloy steels, particularly in semi-fabricated forms. All electric furnace capacity is now being devoted to aircraft alloys, and less critical alloys are being run in open hearth furnaces.

Ordnance production is making a better showing than aircraft, is running quite close to schedule. July output of all types of ordnance, including tanks, was 26 percent ahead of June. Medium 30-ton tanks in particular were rising fast, up 35 percent over June and well ahead of schedule. Light 14-ton tanks, up 15 percent, also exceeded schedules.

Anti-aircraft guns are doing well, as is ammunition, but the record on heavy artillery is rather mixed.

Deliveries of naval vessels in July were 22 percent ahead of June. The record on heavy types was particularly good. Light naval vessels rose also, but less than had been expected.

Bond Publicity — When 97 percent of the employees of Kearney & Trecker started investing 10 percent in war bonds it was decided to help build up general enthusiasm in Milwaukee by having these workers use streamers on cars.

Canada Awaits Washington Action on PRP; CIO Runs Campaign Against Wage Ceilings

OTTAWA—Canadian priority officials were standing by as this was written waiting for clarification of Washington's newest move in the effort to make PRP work. Details of the latest pattern were not known here but the Canadian priority office is proceeding on the assumption that the framework of PRP is not being essentially altered and that the changes made will entail a minimum of dislocation in the administration of PRP in Canada.

While Ottawa has to adopt automatically, under the joint war production agreement, whatever revisions or adjustments are made in Washington's priorities system, this country is largely free from the troubles and difficulties which make these revisions necessary for the United States. This freedom is attributed mainly to Ottawa's having followed an informal system prior to the agreement. Priority and other war production officials here are closely acquainted, through their administration of the informal system, with the situation in all important units of war and essential civilian production. Another factor which saves Ottawa from worries such as keep Washington in turmoil is that since the establishment of Munitions and Supply Department early in the war there has been no conflict between the departments administering the fighting services and the war production authorities. Minister of Munitions C. D. Howe is in complete authority over all production matters. The service departments have no voice in procurements or production. They merely submit their requirements to Howe's department.

Informal Cooperation

Because Ottawa worked informally with industry throughout the war until the adoption of the Washington priorities plan under the joint agreement, any inflation of priority ratings or padding of applications for materials would be quickly detected here. There is now virtually none of it, although an odd case occurred earlier.

At the same time, close coordination of War Industries Control Board branch of Howe's Munitions Department with consumer goods controls under Wartime Prices and Trade Board is smoothing the way for increasing curtailment of supplies for civilian industries. Orders for restrictions are issued jointly by the two boards through joint administrators and are preceded by joint consideration of the supply situation and the position of the civilian industry to be affected. This week the two boards joined in an order specifying the kinds of critical steel wholesalers throughout the country could buy from distributors at ceiling prices.

Many Strikes Threaten

Prevention of threatened strikes in two major units of Canada's primary steel industry and other labor outbreaks is Ottawa's main headache this week. Both Algoma Steel Corporation at Sault Ste. Marie and Dominion Steel and Coal Company at Sydney, Nova Scotia, are under strike votes of CIO unions. The Soo vote was almost unanimous and follows rejection by the union of the award of a regional Wartime Labor Board on a wage demand for an increase from 46½ to 55 cents. Unsatisfied wage demands also caused the strike threat at Sydney. About 4000 steel workers are involved at each plant.

Behind the current trouble is a continuing CIO campaign against Canada's wage ceiling established last fall. Cost of living bonuses under the ceiling law were increased in August by about 60 cents a week following a rise in the cost of living index for June-July.

Oppose Withholding Tax

More immediately feared than strikes in the steel industry where conciliation efforts are now being made is a general worker demonstration throughout war industry against deduction of income tax payments from pay envelopes.

Heat Therapy—This new type skin heater developed at the Glenn L. Martin plant is used to remove the wrinkles from aluminum skin sections that have been riveted together. It is used to heat the skin before it is riveted to the frame which gives a smooth drum-head surface

In order to make sure of collecting heavy increases in income tax imposed in his June budget, Finance Minister Ilsley decreed deduction at the source. These deductions commence in September and industrialists have been warning Ottawa of increasing worker protests. Mainly feared is a spread of absenteeism already mildly prevalent in some industrial areas.

A campaign of propaganda has been organized in an effort to convince workers that the pay-as-you-earn plan for income tax, with deductions at the source of earnings, is necessary to the total war effort. It will be directed mainly to underscoring the fact that the amount withheld for the tax is not a reduction in but a deduction from wages and that employers in making the deduction are not acting on their own initiative but merely obeying the law.

Bar Job Transients

Centralizing of jurisdiction over Canada's new selective service system in Labor Minister Humphrey Mitchell, with Selective Service Director Elliott Little responsible for administration, is aimed at speeding up the mobilization of manpower for the army and war industry. The immediate objective is to stop the increasing drift of workers from one job to another. For this purpose a selective service order now pending will bar workers from applying for any job not referred to them by Little's organization and employers from hiring any person not sent to them by local selective service offices. Employes will be prevented from quitting jobs without notice and employers from firing without good cause. Any remaining jobless will be required to accept work on demand.

Tank Poison — At Canada's Bren gun factory more and more of these Boys anti-tank rifles are being produced. This gun fires a 0.55-inch, armor-piercing bullet

Washington Appointments

WPB, Industry Advisory Committees:

Presiding Officers: M. H. Billings, Carbon & Graphite Electrodes; R. J. Lund, Corundum; John L. Haynes, Heavy Forged Tool; Graeme Darling, Industrial Power Truck; Frank H. McIntosh, Transmitter Vacuum Tube, Radio Transmitter Manufacturers, Radio Receiver Vacuum Tube; Curtis W. Barnes, Collapsible Tube Manufacturers; R. L. Vaniman, Anti-Skid Chain; John Gammell, Carbon Brush.

WPB, Miscellaneous:

Ernest Kanzler, deputy c. airman on program progress; A. F. Shafter, acting chairman, Transportation Committee; R. L. Vaniman, chief, Automotive Branch; Raymond Hart, administrator, Production Requirements Plan.

Office of Defense Transportation:

Norton P. Willis, chief, Export Traffic Section, Division of Railway Transport.

Office of Price Administration:

Martin H. Schmid, chairman, Armament Steels and Alloys Advisory Committee.

BUSINESS ITEMS

Gisholt Machine Co. has recently made several new appointments to its field sales and service staff in the United States and Canada to facilitate more complete and prompt service to customers in the various territories where industrial activity has been increased.

Waltham Grinding Wheel Co., Waltham, Mass., has had a change in management. Officers of the new organization consist of W. H. Bowden, president, formerly with Abrasive Co., Philadelphia; E. Paul Floyd, vice president, formerly with Simonds Saw Steel Co., Fitchburg; H. A. Johnson, treasurer, formerly with Bonbright Co., New York City; and R. L. Lyons, general manager, who has been for many years associated with the Waltham company.

Acme Machine Tool Co. has concluded selling arrangements in New England and New York to replace Henry Prentiss & Co. Lynd Farquhar Co., Boston, will cover the New England states; Rudel Machinery Co., 100 E. 42nd St., New York City, will handle eastern New York State and northern New Jersey; C. H. Briggs Machine Tool Co., Syracuse, the central New York and northeastern Pennsylvania territory; George Keller Machinery Co., Buffalo, western New York, including Buffalo and Rochester.

Champion Diamond Co., 551 Fifth Ave., New York City, has been formed by William Schwartz formerly connected with Anton Smit & Co. for fifteen years.

Doall Company has announced further expansion of its Saw Laboratory which occupies a building separate from the main plant.

The Hays Corp., Michigan City, Ind., has appointed the Energy Control Co., 3107 N. Broad St., Philadelphia, Pa., as representative in that area which comprises the eastern part of Pa., all of Delaware, portions of Maryland, New Jersey, Virginia and West Virginia. Engineering Products Co., 304 Davidson Bldg., Charleston, W. Va., will handle the southern West Virginia field; and Power Specialty Co., 25 N. Live Oak St., Houston, Tex., has been appointed to represent the company in the southeastern Texas territory.

Square D Co. has opened a new branch office at 146 Chestnut St., Springfield, Mass., with C. T. Nash in charge, and another at 303 Kensington Rd., Greensboro, N. C., and W. W. Hendrickson in charge.

Western Mfg. Co., Detroit has made substantial additions to the machine and assembly departments, and the engineering department now occupies a large portion of the recently enlarged office space.

Triangle Engineering Co. has announced the establishment of new offices at 400 E. Nine Mile Rd., Detroit. The company specializes in tool engineering.

Production Devices Inc. has moved its headquarters office to its new plant at Poultney, Vt., from East Hartford.

NAMES in the NEWS

Frederick G. Dawson, who has been connected with United Aircraft Corp. since 1929 and appointed an assistant secretary of the corporation two months ago, has been named general manager of the new Kansas City plant which will build Pratt & Whitney Aircraft engines. Leonard C. Mallet, also associated with the company for the past 13 years, has been appointed assistant general manager.

James H. Davis has been made special assistant to E. F. Johnson, vice president of General Motors Corp. in charge of the Dayton Divisions and Eastern Aircraft Div. He will remain in Dayton where he has been general manager of the Moraine Products Div. Bernard A. Brown has become general manager of the newly consolidated Moraine Products and Delco Brake Divisions known as the Moraine Products Div.

F. M. Hoefler has been appointed vice president and general manager of the Harvill Aircraft Die Casting Corp. of Los Angeles to take over the duties of Henry L. Harvill, head of the company, following his resignation. Mr. Hoefler has been connected with the Douglas Aircraft and Vultee Aircraft organizations.

John H. Collier, who has been associated with the Nicholson File Co. for many years, has been named sales manager, and Howard E. Jenkins, who entered the employ of the company in 1938, has been made assistant sales manager.

M. B. Elliot, transformer specialist for the East Central District of General Electric Co., has become manager of sales of the Unit Equipment Section. He joined the company as a test engi-

Receive G. M. Division Promotions *Die Casting Official*

J. H. DAVIS

B. A. BROWN

F. M. HOEFLER

Nicholson File Sales Manager and Assistant

J. H. COLLIER

H. E. JENKINS

neer in 1920 and was transferred in 1924 to the Regulator and Capacitor Section, and in 1926 he was advanced to the post held until the present appointment.

Ralph Griffith has been advanced to the position of sales manager of Drive-All Mfg. Co., Detroit. He succeeds C. A. Cowdrey who has been made general manager of the company.

William E. Vogt, connected with the Union Carbide and Carbon Corp. for more than 30 years, has been appointed secretary of Electro Metallurgical Sales Corp., a unit of Union Carbide, with headquarters in the New York office.

William A. Harding has been announced as manager of sheet, plate and specialties of the Jessop Steel Co., Washington, Pa.

John Munro has been promoted to the position of vice president of the

Advanced to Secretary

W. E. VOGT

Whiting Corp. in charge of a new Procurement Div. which will include purchasing, expediting and priorities. Appointments of H. W. Anderson to vice president of the Aviation Div. and M. J. Rice as vice president of the Quick-work-Whiting Div. have also been announced.

R. E. Powers has been named Pacific Coast district manager of the manufacturing and repair department of Westinghouse Electric & Mfg. Co. He has been with the firm since 1936.

R. H. Langdon has been appointed field engineer Pittsburgh district of Norton Co., and E. P. Gregory has been made field engineer in the Chicago district. Both men have had considerable experience in the research laboratories and the sales engineering department of the company.

J. J. Boughey has been appointed district supervisor of safety of Carnegie-Illinois Steel Corp., and A. D. Sweeney has become director of safety of the South Works, succeeding Mr. Boughey. Both men have been employed by the corporation for several years.

William N. Grooms of Salt Lake City has been made district sales agent for Roller-Smith Co. and will handle its products in the states of Utah, Idaho, Montana and southwest part of Wyoming. His headquarters are at 630 Dooly Block.

OBITUARIES

Gordon Stoner, 62, vice president and general manager of the Midland Steel Products Co., died after an illness of seven months. He joined the Detroit Pressed Steel Co. in 1919 which was later merged to form the present organization.

Norton A. Mears, vice president in charge of purchases of R.C.A. Mfg. Co., Inc., passed away recently at Philadelphia.

John F. Wyzalek, 47, a nationally known authority on heat-treatment of metals and carburizing methods and chief metallurgist for Hyatt Bearings Div., General Motors Corp., Harrison, N. J., died suddenly after a heart attack.

Francis J. Arend, president of the De Laval Separator Company, died recently. He had been connected with the company since early youth and was president for 25 years.

Frank L. Cogill, formerly president of the Coulter & MacKenzie Machine Co., Bridgeport, Conn., died after a long illness.

Orra L. Hollister, 79, president of Federal Malleable Co., West Allis, Wis., passed away.

Henry J. Anderson, 72, vice president of Specialty Brass Co., Kenosha, Wis., died recently. He and his brothers established the Anderson Bros. foundry which was later incorporated and formed the present company.

Charles Katchem, 59, superintendent of the shop of the Schwab Boiler & Machine Co., Milwaukee, died in that city.

William F. Kinsella, 59, vice president and treasurer of Worden-Allen Co., Milwaukee, structural steel fabricators, passed away recently.

MEETINGS

National Safety Council. Annual meeting. Stevens Hotel, Chicago, Ill., Oct. 5-9.

National Metal Congress and Exposition. War Production Edition. Cleveland Public Auditorium. Oct. 12-16.

American Welding Society. Annual meeting. Hotel Cleveland, Cleveland, Ohio. Oct. 12-16.

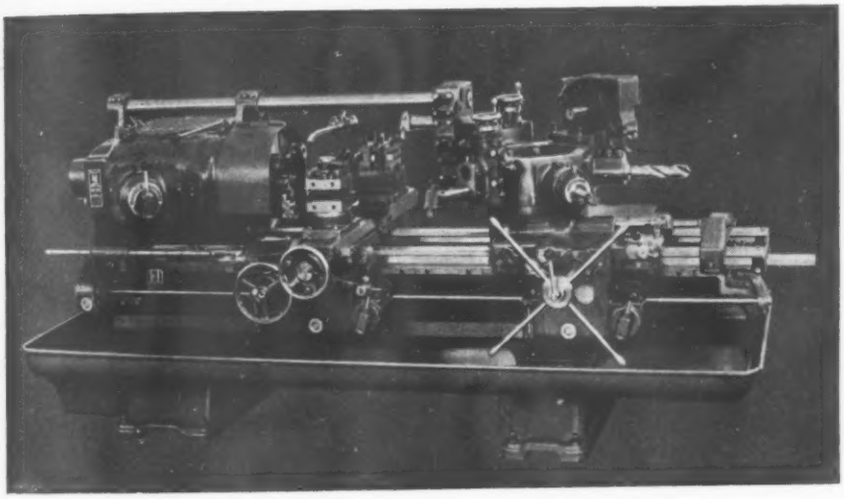
American Society of Tool Engineers. Semi-annual meeting. Kimball Hotel, Springfield, Mass. Oct. 16-17.

Wire Association. Annual meeting. Detroit-Leland Hotel, Detroit, Mich. Oct. 19-23.

National Electrical Manufacturers Assn. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Oct. 26-30.

SHOP EQUIPMENT NEWS

Jones & Lamson Nos. 9A and 10A Turret Lathes Obtain High and Low Traversing Speeds by One Lever



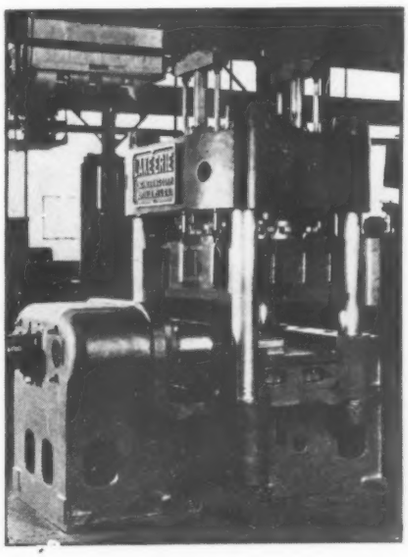
Announcement has been made by the Jones & Lamson Machine Co., Springfield, Vt., of the No. 9A and No. 10A saddle type universal turret lathes. The maximum round bar capacity of the No. 9A lathe is 3½ in. and will swing 23½ in. over the way covers. The No. 10A machine has a maximum round bar capacity of 5 in. and will swing 27½ in. over the way covers. Among the features of these machines is power traversing of the saddle and power indexing of the hexagon turret, both operated by one lever, through which both high and low positive traversing speeds can be obtained. This feature allows the machines to be provided with particularly heavy-walled turrets permitting larger than normal boring bars to be supported without need for pilots. Additional support for the multiple turning heads is provided by a heavy stationary pilot bar mounted on the headstock. The heavy-duty headstock has anti-friction transmission and spindle bearings throughout.

A time and labor saving feature of these lathes is the built-in power rapid traverse for the bridge type carriage and cross-slide, which has an all-gear drive and is operated by a single lever through which all four movements of the carriage and cross-slide or a combination of these movements can be obtained. The bar-feed mechanism is power operated. A reversible torque motor, which is controlled by an electric switch located on the headstock of the machine actuates the stock feed chuck lead screw through a gear train, and either advances or withdraws the stock on this machine as required.

The bed on the No. 9A machine is of an improved double-wall box-ribbed design, and is 17 in. across the ways, and 20 in. across the ways on the No. 10A lathe, giving strength and solid rigid support for both carriage and saddle. Special provision has been made for easy and efficient chip disposal.

Lake Erie Hydraulic Press Molds Phenolic Plastics

Introduction has been made by Lake Erie Engineering Corp., Buffalo, N. Y., of a 450-ton angle-type hydraulic press

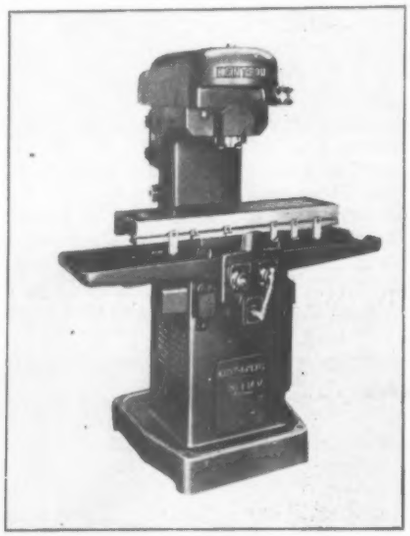


for molding phenolic plastics, having vertical and horizontal operating units as illustrated. It is complete and ready for connection to accumulator pressure system. The main bed of the press is cast in one piece to maintain correct vertical and horizontal alignment and is of rugged design.

The platen of this press measures 24×50 in. The vertical stroke is 12 in. and the horizontal stroke is 10 in.

Kent-Owens Miller Performs Rapid Vertical Operations

For rapidly performing vertical milling operations on small parts the Kent-Owens Machine Co., Toledo, Ohio, has introduced the No. 1-14V vertical milling machine. It is a floor-type machine, the box-type bed completely inclosing the motor and hydraulic pump unit for actuating the table that rides directly in ways on the bed. The table has feed in both directions, rapid traverse in both directions, automatic shift from rapid traverse to feed in either direction and



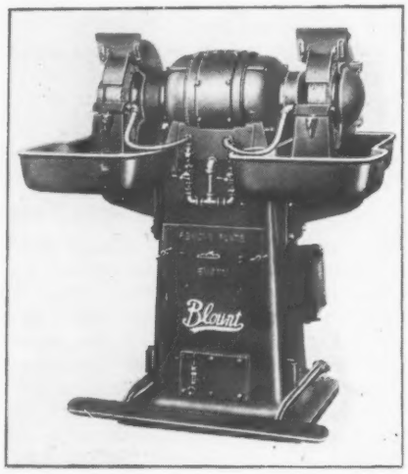
automatic reverse at both ends of the stroke. Dogs can also be provided for intermittent milling.

The spindle head has cross adjustment by means of a screw and micrometer dial and moves in long narrow ways in the head carriage. This is adjustable vertically on two ground cylindrical steel posts. Ten spindle speeds ranging from 115 to 300 r.p.m. are quickly available. Interchangeable V-belt pulleys are used with an intermediate adjustable pulley for providing full speed range and keeping the

belts in proper tension. By raising the hinged cover on the spindle head and properly setting the V-belts spindle speed changes can be made. The machine can be equipped with either a one- or two-way positive stop with dwell.

Blount Model J Wet Grinder Equipped With Coolant Ejector

J. G. Blount Co., Everett, Mass. has announced a Model J wet grinder with two straight face wet grinding wheels equipped with water pans of generous capacity, having rounded corners and



finished with a smooth surface for quick and complete cleaning. The pump is of centrifugal motor-driven ball bearing type, and all bearings are well above the water line. The coolant is pumped through regulating valves to the grinding wheels.

A coolant ejector is incorporated in the grinding rest. At the face of the rest there is a series of holes or jets through which the water is forced against the grinding face of the wheel. This feature has the advantage of keeping the tools cooler and of cleaning the wheel as it grinds. The entire rest assembly is adjustable for wheel wear. The motor of the machine is totally inclosed and has a manually operated switch with overload motor protection. The base of the column of the grinder measures 22×19½ in. and the height from the base to spindle is 37½ in. The net weight is 925 lb.

Ergolyte 250 F Arc Welder Features Air-Cooling System

A feature of the new super duty 250 F a.c. arc welder, produced by Ergolyte Mfg. Co., Dept P9, Lawrence St. at Erie Ave., Philadelphia, Pa., is air cooling. Because of its built-in forced draft cooling system and extra heavy insulation the machine is claimed to withstand continuous welding twenty-four hours a day, every day. The control panel is inclined to reduce cutting temperature adjustment time. Specifications of the arc welder include 15-250 amp. current range, input voltage of 230-460 volts, 60-cycle frequency, operation on single phase or one phase of a two or three phase current, twenty-four heat steps. The size of the cabinet is 18×13¼×31½ in., weight 215 lb.

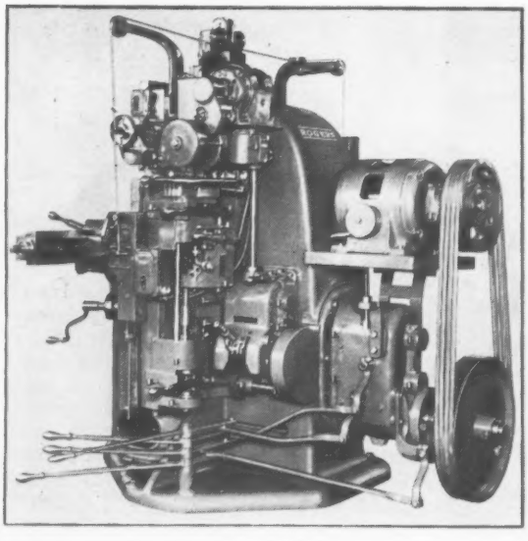
Two Operations at Same Time Handled on Rogers Turret Mill

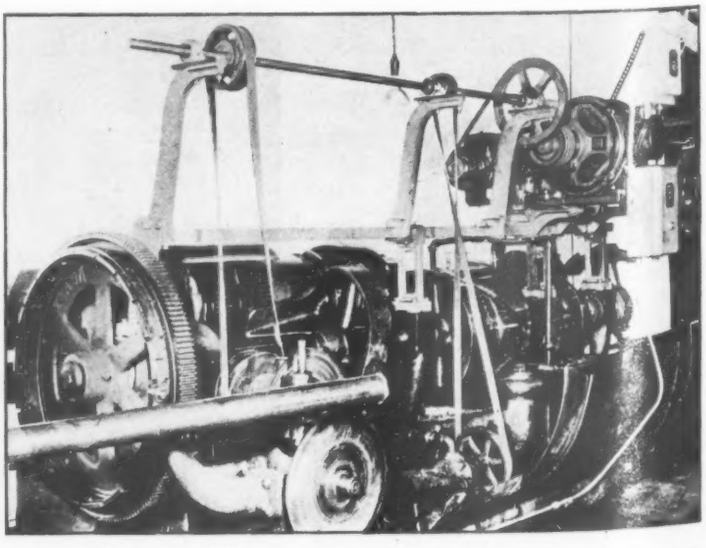
Designed for boring, drilling and turning ferrous and non-ferrous castings, forgings and similar parts, the Rogers Machine Works, Inc., 125 Arthur St., Buffalo, N. Y., has introduced a "Perfect 36" model turret mill. Two operations on the work can be performed at the same time by means of specially designed swivel head and main head. Quicker and simpler tool setting for irregular pieces is made possible by the ability to set the side head at any angle up to 35 deg. either way. The table level horizontal chuck allows the work to slide easily into exact position eliminating the balancing of the work while clamping to the chuck.

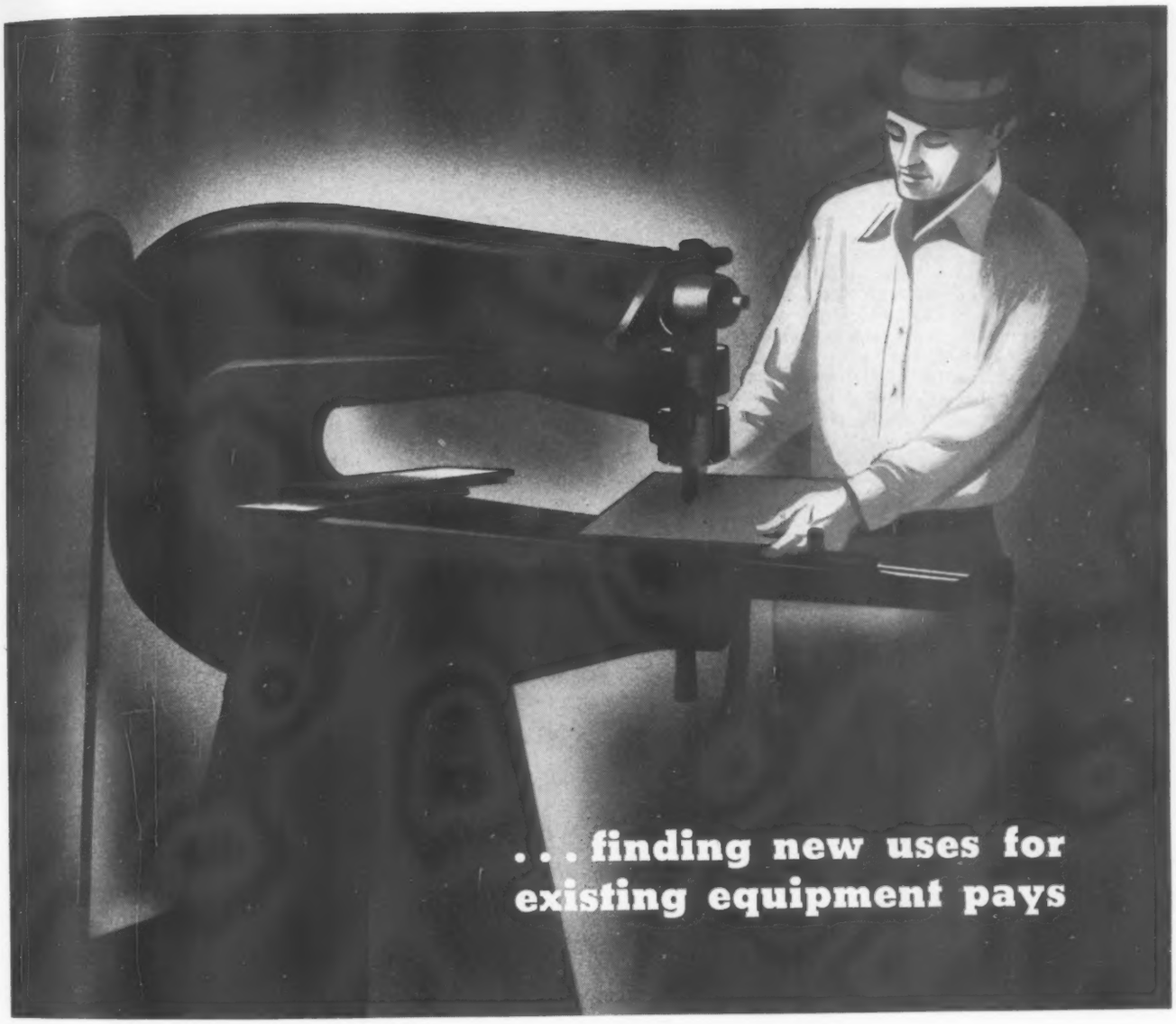
The turret mill has a motor-driven rapid traverse, heavy-duty main clutch that runs in an oil tight case and convenient foot controls. The capacity of this model is 36 in. diameter. The table face to turret face is 24 in. maximum. The main head and side head have eight vertical and horizontal feeds each. Spindle speeds can be set to any one of eight speeds.

Drive-All Unit Replaces Two or Three Motors With Only One

An individual motorizing installation calling for only one electric motor to drive all the units on a belt-driven Cleveland Automatic, instead of the two or three formerly needed, has been developed by the Drive-All Manufacturing Co., 3404 Conner Ave., Detroit, Mich. The gear box and motor are attached to the machine, using standard brackets and this same supporting standard mounts the jackshaft that drives both the pump and the feed.







Information supplied by "American Machinist"

No one in industry needs to be reminded that getting the last ounce of production out of existing machines is of vital importance. The question is much more apt to be one of *how* machines *can* be utilized to the best advantage.

Sometimes it is a matter of finding jobs that machines are normally equipped to do. Sometimes it is a matter of adapting them to work for which they are suited, but for which they are not primarily designed.

A case in point is the use of a nibbler for various sorts of odd jobs around a shop. It is used to cut fiber board and thin metal sheets into a variety of shapes for a number of different purposes.

As to efficiency, the operator claims that the nibbler is both easier to use, and does a faster job than saws or shears ordinarily used for such work.

CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Molybdenum Company
500 Fifth Avenue • New York City

MOLY

A 1½ in. square bar running the full length of the machine provides a backbone for the installation, and a base on which to mount the various brackets.

Hammond Wet Tool Grinder Can Be Converted for Carbide Tools

A Model 20-S wet tool grinder has been introduced by Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich. It can be easily converted to the grinding of carbide tools as well as for regular tool and snagging work by replacing the work rest with an 8×8 in. tilting table.

The tool rest is adjustable to any desired angle and has replaceable steel wearing plate. The wheel dresser is an integral part of the assembly. The entire unit adjusts in and out from the wheel by means of a detachable hand crank which actuates a protected screw

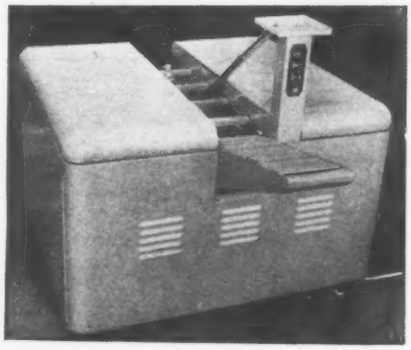
mechanism. Easy regulation of the coolant flow is provided by the circulating coolant system with regulating valve located in the sludge pan to the right of the tool rest. The detachable splash guard gives added protection to the operator. The 3-hp. totally inclosed fan-cooled motor is located in the base with a push button starter of the magnetic type with overload, low voltage and phase failure protection.

The machine is furnished with a grinding wheel of 20 in. dia. by 2½ in. face, with a 9 in. hole for mounting on a large hole wheel flange. By removing two cap screws the hinged cover swings out of the way to give further accessibility to the wheel.

Watcher Automatic Machine Makes Ends of Brass Percussion Primers

An automatic machine for making bodies of brass percussion primers which are threaded in both ends has been announced by Watcher Design Co., 2423 Bremont Ave., Cincinnati, Ohio. The machine is adaptable to the several lengths up to 10 in., and to other products which can be moved and rechucked for various operations by any number of spindles.

Tubing cut-to-length is fed into a hopper at the front and the finished part rolls out the back. Both ends of the work are faced, counterbored, reamed and tapped. There are extra open stations in the work carriage which allow rapid removal of any piece after any operation for inspection and substitution with an inspected



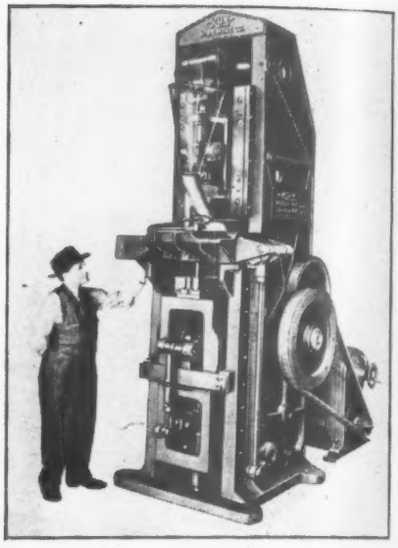
tube. A plug is fed from a magazine and is automatically screwed in and locked by spinning. If the plug is not inserted or screwed in far enough, electric gages which check it stop the machine so that the piece may be reclaimed and rerun.

There are several relief and safety devices, including a general system which contacts and protects the work throughout its traverse and applies a motor brake for an instant stop. The chips and oil are blown from the tube before the plug is screwed in, which reduces contamination of the degreaser solvent later. Oil is pumped to all tools.

The six spindles and pulleys and the automatic screwdriver attachment run on ball bearings and are driven by individual motors and V-belts. Backlash in the spindle movement is suppressed by springs. The tools have fine adjustment and individual cams which graduate the feed to the metal removal rate or to the lead for threading. The size of this machine is 5x5 ft. and weighs less than a ton.

Kux Model 74 Press Produces Parts From Powdered Metal

One of the largest machines of its type for producing parts from powdered metals and ceramic materials is the Model 74 automatic press produced by Kux Machine Co., 3944 W. Harrison St., Chicago, Ill. Odd shapes of parts with complicated, cored holes, protruding lugs and various sectional thicknesses to micrometer accuracy can be made on this machine. It is completely automatic in operation. Applying up to 50 tons total pressure, the press will produce parts up to 5 in. maximum dia. and has a powder cell or die fill of 5½ in. maximum.



An agitated feeding shoe transmits the material from the supply hopper to the powder cell in the die. The die fill which is controlled by an adjustment device can be increased or decreased when desired so that wafer thin parts, or parts with thick sections can be made. Built to use multiple, telescoping punches and movable core rods, which apply the pressure to the material being formed, the machine has been designed with separately controlled mechanisms for operating each punch or core rod. The pressure being applied by each of the punches and movable core rods is individually controlled and adjusted at the front of the machine.

Both upper and lower punches held in flange type punch holders are mounted to heavy steel punch carrying slides which operate in V gibs, adjustable for wear. Movable core rods are mounted to separate operating mechanisms, while all stationary core rods are held in place by a stationary core bracket which is fastened to the main frame directly below the lower punch. Thus short, strong core rods can be used.

The press has a one-piece steel cast main frame 11 ft. high and weighs about 13,500 lb.

Logansport Power Unit Built for Hydraulic Chucking Installations

Designed for hydraulic chucking installations on machine tools but adaptable to other similar applications, Logansport Machine, Inc., Logansport, Ind., has brought out the new Model 5036 hydraulic power unit. It is capable of operating not only additional cylinders for tailstock or similar requirements but sustains the pressure during the different executions of the work cycle. A spring loaded accumulator permits maintaining of this pressure without the electric motor running constantly. When the accumulator has been charged to 550 psi., a built-in standard-make pressure switch of a non-diaphragm type automatically

The Tool of Peace goes to War....

The iron or "trade" tomahawk—trade mark of Genesee products—was the first real contribution to better tooling in this country, being used as a general purpose tool by the peaceful Senecas of Je-nis-hi-yeh.

Last month alone . . . Genesee delivered more "Tomahawk" Quality cutting tools to Industry for the war effort than it produced in the entire year of 1939.

YET, GENESEE TOOL COMPANY is not a "war baby". It was incorporated in 1934 to supply the needs of automotive companies in Detroit, in Lansing, in Flint, in Pontiac. . . . Growth through the first years was purposely gradual. In those first years Genesee acquired and developed an organization second to none in the designing and production of cutting tools.

In recent years Genesee's growth has been accelerated. Its original plant was expanded, re-equipped with the most modern of tool production equipment available . . . a second plant was acquired and equipped . . . a corps of trained field representatives was appointed, covering virtually every major industrial center.

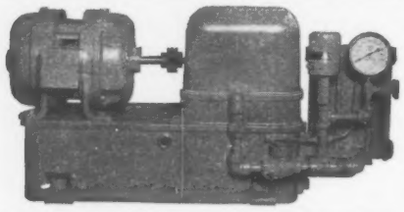
Today it ranks as one of the most modern tool companies in the country, producing practically every type of tool used in industry . . . H.S.S. and carbide . . . standard and special . . . for turning and forming, reaming and counterboring and milling, etc.

We will be glad to send you a streamlined condensed catalog of Genesee tools. Ask for catalog No. GT-42AM

GENESEE TOOL COMPANY

FENTON, MICHIGAN

★ *Registered Trade Mark*



shuts the electric motor off. When the accumulator has discharged sufficient oil to reduce the hydraulic pressure to 450 psi., the pressure switch will again start the motor. Therefore, the motor which drives the pump remains off for the greater part of the machine operation. The motor is 3 hp., 1200 r.p.m., oil capacity of the tank is approximately 15 gal. and capacity of the accumulator is 50 cu.in. at 550 psi.

Volume Hardness Testing Possible On New Steeltest Instrument

A production hardness tester, designed for volume hardness testing with a maximum capacity of 2,400 accurate hardness tests per hour, is introduced by Steeltest Instrument & Mfg. Co., 14212 Fenkell Ave., Detroit, Mich. Provision has been made for hopper-feed continuous cycle, or hand-feed single cycle operation. Conversion from continuous to single cycle foot-switch operation is instantly made by the flick of a switch which controls an ingenious electrical braking system incorporated in each instrument.

Direct readings showing actual hardness numbers in all standard Rockwell scales are given on a 100 division dial with one set of black numerals. No charts or comparison tables are required. Penetrator is standard 120 deg. cone with 0.2 mm. radius interchangeable with chucks for 1/6 in. and ⅛ in. steel balls.

Dead weight loading system applies 10 kg. minor and 60, 100 or 150 kg. major loads through a uniquely compensated loading beam actuated by a direct coupled uniform motion cam drive. Power supply is 1/15 hp. 60 cycle, 110 volt a.c. arranged with 60 to 1 reduction unit.

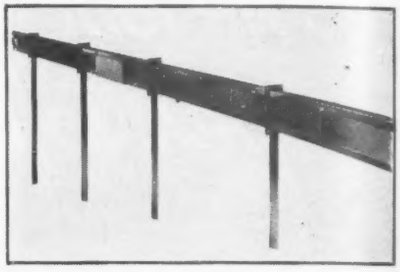
No dash pot is employed and operation is not affected by climatic conditions. Hardness testing is practically automatic, the only manual operation being the hand elevation for initial setting of one specimen in each batch run, and the feeding of the specimens. Correct initial setting is assured by a red flasher signal located at operator eye level.

Low Reactance Feeder Duct Used for Minimum Voltage Loss

A low reactance feeder duct known as the "Saflex" has been developed by the Switch and Panel Division, Square D Co., Detroit, Mich. It is designed primarily to serve as the feeder between transformer banks and main switchboards or as feeders to branch circuits where minimum voltage loss is essential.

The duct is idealy suited also for welder circuits as it provides a compact conductor of low voltage drop (only 1.8 volts per 100 ft.) and therefore conductor size may be kept at a minimum. As it is principally inclosed in special non-critical non-metallic insulation, iron losses and hum, as well as the pulsations sometimes experienced from the impact of heavy welder loads in other types of feeders are eliminated.

Balanced phases are provided at all points because of a special split—bus



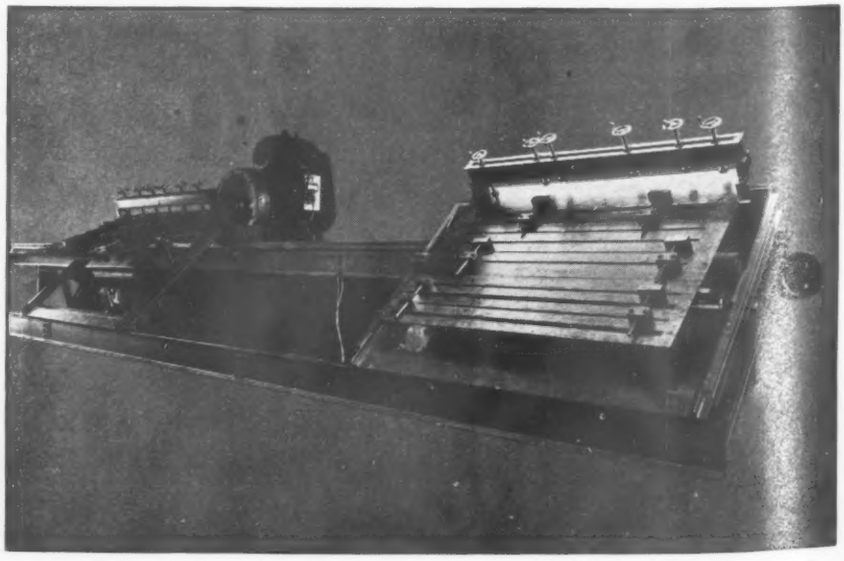
arrangement which provides electrical symmetry of the phases. In full-load tests this duct has only a 38 C. temperature rise.

It is available in capacities from 500 to 6,000 amp., 600 volts or less for single-phase, two- and three-phase and three-phase, four-wire services.

Vonnegut LG Type Armor Plate Grinder Bevels Straight-Line Edges Preparatory to Welding

The LG Type armor plate grinder brought out by Vonnegut Moulder Corp., 1819 Madison Ave., Indianapolis, Ind., consists essentially of a stationary grinder unit, 45 ft. tracks and twin traveling work tables. The grinder bevels straight-line edges of armor plate preparatory to arc welding into the shells of tanks and armored cars. Cutting is provided by a 36-in. diameter abrasive chuck wheel supported on a 6-in. diameter spindle in long tapered babbitted bearings with ball bearing thrust collar and powered through eight strands of V-belt from a 40 hp. motor.

The two work tables are adjusted angularly by means of heavy screws to provide for edge bevels of from 90 to 25 deg. One table is operated while the other is being unloaded, loaded and set up, providing for almost continuous production. The tables travel on ball bearing rollers upon hardened steel tracks. The upper rollers and tracks are set at proper angles to resist the grinding wheel forces. Table travel is actuated by a cable drive with choice



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FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

THROUGHOUT THE NIGHT DETERMINED MEN MAKE BATTLE STEELS

Like commandos on attack, stalwart steel men come in the dead of night to work till dawn, grim in their determination to produce speedily the fighting steels to arm your sons and brothers on the battle fronts. On the night-turn, thousands strong, come men like the metallurgist who added the final touch in perfecting a new armor steel; like the melter who now makes that steel two-hundred tons at a time.

There come men who roll wide steel plates for ships and miles of tubes for bombs and those who forge and machine glistening shells from steel made by their fellow workers. There are the coke workers, the blast furnace men, the melters, blowers, heaters, rollers, finishers — workmen of many trades and skills — all doing their part to furnish steel for ships, tanks, guns, planes and other fighting equipment.

These men of steel, by their will-to-do to help win this war, achieve new high records in production night and day, month after month. Every ton of steel they make is shipped to war.

CONTROLLED QUALITY WAR STEEL

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

of 25, 30 or 35 ft. per min. rate of feed. Quick acting clamps connect the table to the cable or disconnect it. Cable power is supplied by a 3-hp. motor and the coolant pump is driven by a 1-hp. motor. Push button control operates all three motors.

Westinghouse Voltage Regulator Is Built On A Micarta Panel

Announcement of the DT-5 electronic voltage regulator for a.c. and d.c. generators has been made by Westinghouse Electric & Mfg. Co., Dept. 7-N-20, E. Pittsburgh, Pa. The unit operates

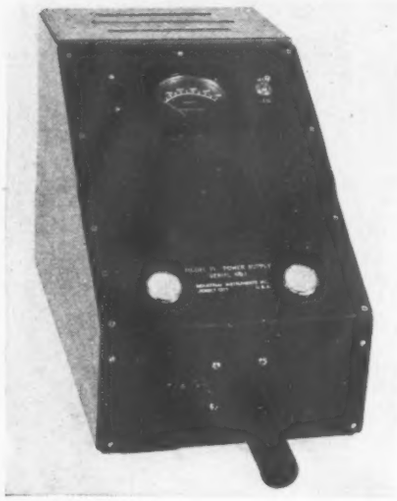
from a three-phase a.c. power supply and acts as a grid-controlled rectifier to supply the d.c. field current to the generator or the exciter of the generator being regulated. The sensitivity is plus or minus ¼ percent when a.c. supply voltage does not vary more than plus or minus 5 percent from normal rating.

This regulator is made for master panel mounting and is built on a Micarta panel 1 in. in thickness with a built-in anti-hunt circuit. This circuit prevents the regulator from overshooting when close regulation is required.

Industrial Instruments Introduce Two Voltage Breakdown Testers

Two types of voltage breakdown testers have been introduced by Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. Y., for testing voltage breakdown of materials or components. The Type P-1 model operates at 0.4,000 volts d.c. and the Type P-3 at 0-10,000 volts d.c., both continuously variable over the entire range.

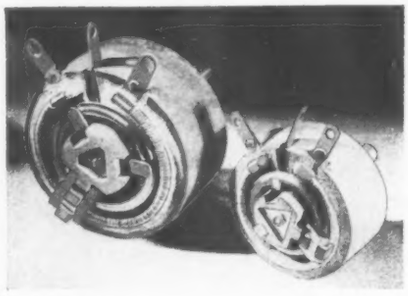
The tester is housed in a sturdy metal cabinet with sloping panel. The instrument consists of a set-up transformer which is accurately controlled by a variac, a relay indicating by means of a panel light when a breakdown occurs, a meter providing direct-reading voltages, the rectifier and filter circuit



providing the high voltage d.c. and current limiting resistors safeguarding the equipment in case of a dead short. A self-incorporated safety switch makes the power supply inoperative if the chassis is removed from the case or disturbed otherwise.

Clarostat 50-Watt Rheostat Serves Extra Heavy-Duty Use

An extra heavy-duty 50-watt power rheostat has been introduced by Clarostat Mfg. Co., Inc., 285-7 N. 6th St., Brooklyn, N. Y. The selected resistance wire is wound on an insulated metal core which distributes the heat at intermediate rotational settings. The resistance element is firmly imbedded in a ceramic housing with an inorganic cement. Two positive sliding contacts are provided by a graphited-copper contact shoe which rides the collector ring and the winding. Contact pressure is provided by a



helical spring concentrically mounted about the shaft whose action is evenly distributed by use of a tripod-type contact carrier. The rheostat is available in any resistance value up to 10,000 ohms.

Bearings Cleaned and Dried In Ahlberg Bearing Washer

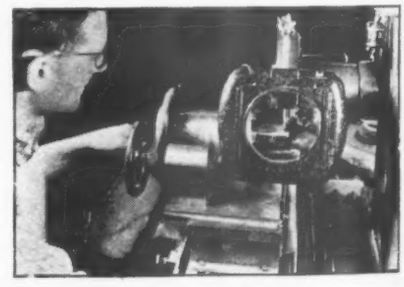
An adaptation of a production type bearing washer for washing and drying bearings has been introduced by Ahlberg Bearing Co., 3050 W. 47th St., Chicago, Ill. A bearing is washed free from dirt and old lubricant and then ready for repacking. This unit is easily portable and has a sealed compartment to prevent evaporation loss of the solvent solution. Provision is made for a compressed air dryer which blows the bearing dry and clean, making the *whole operation complete and easy* in a minimum of time. The unit weighs 10 lb. and handles a full range of bearing sizes.

An additional unit for repacking the cleaned bearing with fresh grease is a second development. With 5 lb. of clean lubricant in its base the bearing is simply placed on top of the unit and a lever forces the clean grease completely through the bearing.

Boyer-Campbell Makes Four New Model Magnifying Lenses

Four new models of "Super Sight" have been announced by the Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich. The No. 95ZC model has two magnifying lenses, the top lens having 5 in. dia., lower lens 4 in. The lower lens is adjustable to proper focus. Both lenses light separately, permitting the use of one or both as occasion requires. The head is balanced to a bracket and can be put in any position instantly over a wide bench area.

The No. 89ZC "Super Sight" has one magnifying lens of 5 in. dia. and is used



for inspection of small parts assembly and bench work. The No. 89U has the same size lens and is equipped with universal brackets, and used for precision machining.

The 44ZC model has a 4 in. magnifying lens and is for bench work and small parts assembly.

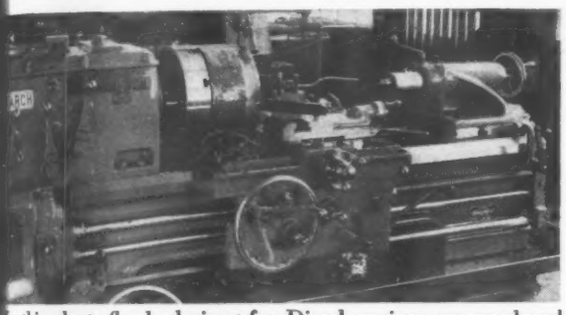
Holes Up to 12-In. Ground In Abrasive No. 1G Grinder

An internal grinder No. 1G has been announced by the Abrasive Machine Tool Co., East Providence, R. I., which will grind holes from ¼ in. to 12 in. in diameter. It has a longitudinal travel of 8 in. and spindle crossfeed of 3½ in. The crossfeed and longitudinal feed are provided with hand wheel graduated 0.001 in. The grinder may also be used for external or cylindrical grinding within its capacity.

The work spindle is graduated and swivels to enable grinding tapers up to a 90 deg. included angle. The Dumore ½

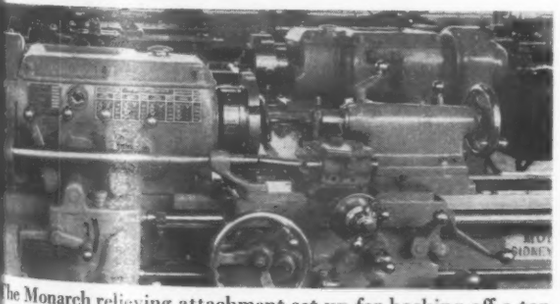
TEAMWORK
does the job at York, Pa.

Earnest attitude of this highly-rated operator of York County is indicative of spirit prevailing throughout the area. Coarse Acme thread being chased on a Monarch lathe without a steady rest. Work is rough cut with a square nosed tool and finished with forming tool.



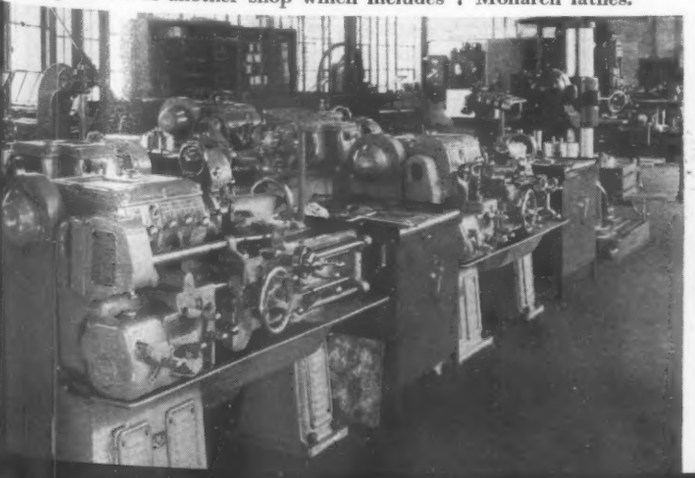
In this plant, flywheel rings for Diesel engines are produced from 1035 cast steel tubes 18" in diameter and 20" long. With one chucking, they are bored, turned and cut off on a Monarch lathe. No chatter even at 20" from the chuck.

Breech end of trench mortar tube being finished at another plant in the York area. In background, another Monarch set up for chucking operation on a housing for hydraulic press.



The Monarch relieving attachment set up for backing-off a tap.

Lathe department of another shop which includes 7 Monarch lathes.



York County has shown the way. Through the fine co-operation of plants in this area, guns, mounts, trench mortars, and other Victory essentials are pouring out of this arsenal, on time. Teamwork has done it.

We at Monarch are proud of York's record, too. Proud because Monarch lathes are used so extensively throughout the plants in the area. In 26 shops, you'll find Monarchs on the job, day and night, saving time, turning out superior work with the finest precision. York users like Monarchs because of their complete dependability under today's severe service. Operators like them because they're easy to use, deliver a bigger day's work with less fatigue.

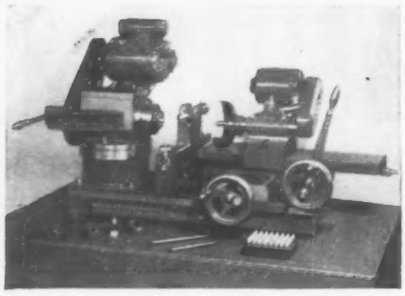
As in York County, Monarch lathes are at work throughout the country, helping build the implements of Victory. Although we are delivering twice as many Monarchs in 1942 as in 1941, they're as trustworthy, as efficient, as accurate as always.

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, OHIO

MONARCH LATHES

COVER THE TURNING FIELD

Student in York Vocational School turning large diameter shaft, on Monarch lathe. Note tailstock overhangs bed, yet heavy cut is being taken. Because students move from training on Monarchs to production on Monarchs, they do faster, better work and help York set its splendid record of accomplishment.



hp. motor driven precision wheel spindle has a range of 6 speeds, 4,600, 6,500, 8,600, 14,600, 32,500 and 42,500 r.p.m.

The grinder occupies a space of 45 × 28 in. and height of 25 in. to the top of the work spindle motor.

Jackson Produces Eye Shield For Attachment to Helmets

An eye shield which is easily attached to helmets has been brought out by Jackson Products, Detroit, Mich. It is made to protect the welder's eyes dur-

ing operations other than welding. The shield tends to eliminate reflected glare and affords wide vision.

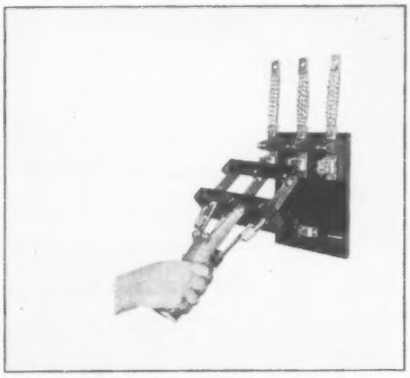
This shade is light green, fits the face comfortably and may be worn over prescription glasses. The welder can raise or lower it with a quick movement.

Sticht Hand Tachometer Is Three-Range Instrument

Announcement of a Model J hand tachometer, which is a three range instrument covering all speeds from 300 to 12,000 r.p.m., has been made by Herman H. Sticht Co., Inc., 27 Park Place, New York, N. Y. The speeds are divided into three ranges, 300-1200 r.p.m., 1000-4000 r.p.m. and 3000-12,000 r.p.m. The instrument is of the centrifugal type and changes in speed are instantaneously indicated. The operating mechanism is on ball bearings and oilless bearings requiring no lubrication. The dial is 4 in. in diameter. The tachometer is supplied with a set of accessories, including a wheel disk for reading surface speeds in feet per minute.

Burndy Cable Disconnector Simplifies Work Shifting

Development of a cable disconnector made to accommodate either three or four conductor cables has been announced by Burndy Engineering Co., Inc., 107 Eastern Blvd., New York, N. Y. It is mounted inside the box of a safety



switch, only 10 in. longer than the standard box, and arranged so that the cover cannot be opened unless the switch is in the open position. A series of foolproof steps accomplish connecting and disconnecting quickly. An additional clip and blade serve to ground the spider casting when the unit is closed. The flexible braids are attached directly to the terminal pads on the load side of the switch.

P-14 Westinghouse Instruments Made for Portable Field Use

For general field service use where an inexpensive unit is required the Westinghouse Electric & Mfg. Co., 7-N 20, E. Pittsburgh, Pa., has introduced P-14 portable a.c. and d.c. instruments. The

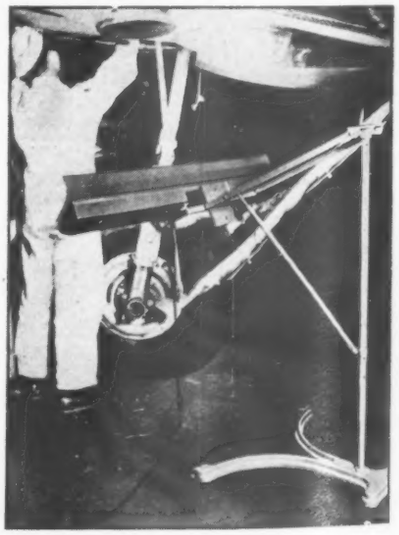
molded cases are fully insulated and magnetically shielded from stray field influence. They are available either with or without covers and are equipped with a mirrored dial and knife-edge pointer which help in making close and accurate readings. The scale length is 3.2 in. a.c. and 2.8 in. d.c. and the units have an accuracy of plus or minus 1 percent of full scale.

A variety of single and multi-ranges is embodied in the P-14 providing for the measurement of a.c. volts, amperes and milliamperes; d.c. volts, amperes, milliamperes and micro-amperes. Combinations such as four current and three voltage ranges make this a complete and flexible instrument.

Lumidor Fluorescent Light Reaches Inaccessible Places

A portable fluorescent service light which is adjustable from 30 in. to 7 ft. and designed to project light into many inaccessible places has been developed by the Lumidor Mfg. Co., Los Angeles, Calif. This light has been used in aircraft plants to throw light under the wings and fuselages of planes which are in shadow from overhead lighting. For outdoor use the light is tipped and rolled on its casters and throws illumination in any direction.

The unit is adjustable without the use of tools upward, downward, hori-



zontally or vertically, or in any angle of a 180 deg. arc. It has a well-balanced base to prevent upsetting. Included also is a power factor correction for the two 48 in. 40-watt lamps and a high baked enamel reflector. If desired, a screen to protect the lens is available.

Elms Engineering Works Builds Six-Plunger Hydraulic Pump

A six-plunger, fully inclosed, horizontal, hydraulic pump has been added to their line by the Charles F. Elms Engineer-

Anne Clark's refrigerator is helping to flatten Essen

If you have ever tried to lift a mechanical refrigerator, you know the weight of metal that is in them. So when Uncle Sam diverted to munitions all the critical materials in these precision machines, he took a long step toward shortening the war. Equally important, he gained the use of some of the world's foremost manufacturing plants with their skilled management, trained workers, and productive machinery.

In many of these plants, conversion from refrigerators to war materials was speeded up and made smoother by the cooperation of the Revere Technical Advisory staff. For Revere not only furnishes industry with sound copper alloys, but also supplies practical assistance in methods of processing and fabricating.

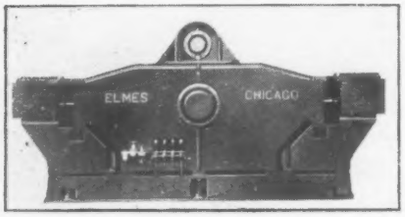
Today, every ounce of copper goes directly into the essentials of warfare. There is none for any other use. Fortunately, Revere is well prepared, with modern plants, improved machines and advanced techniques, to fill a heavy share of our country's needs. And in Revere's laboratories research is tirelessly pressed forward to help shorten the hours before victory.

The Revere Technical Advisory Service functions in (1) developing new and better Revere materials to meet active or anticipated demands; (2) supplying specific and detailed knowledge of the properties of engineering and construction materials; (3) continuously observing developments of science and engineering for their utilization in production methods and equipment; (4) helping industrial executives make use of data thus developed. This service is available to you, free.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK

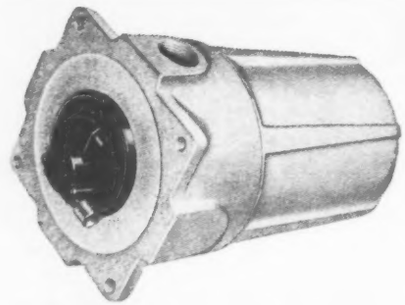


ing Works, 1001-1003 Fulton St., Chicago, Ill. It is modern in appearance and embodies the latest principals of design and construction. All moving parts are pressure lubricated and the connecting rods run in a continuous bath of oil. Roller bearings are used throughout.

Maximum capacity of the pump is 400 hp. Herringbone gears, running in a continuous bath of oil, are used for driving the pump, insuring long gear life. The pump is compact and is particularly adaptable for accumulator systems. It can be equipped with built-in bypass valves or safety valves, as may be desired.

Cramer Type TD1C Time Delay Relay Is Made Explosion-Proof

An explosion-proof timer, which is suitable for operation in atmospheres containing gasoline, naphtha, acetone, lacquer solvent, pertoleum and other explosive materials, has been announced by R. W. Cramer Co., Inc., Centerbrook, Conn. The Type TD1C



time delay relay shown is laid out for panel board mounting with the setting knob and dial projecting. Within this housing it is desirable to mount either a TD1C or TD1 with a small relay. Where it is required to control the timer from remote located momentary start button the latter construction is used.

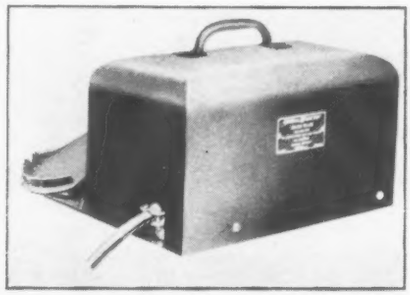
Empire Tool Adds Six Holders For Use With Screw Machines

Six new toolholders have been introduced by the Empire Tool Co., 8790 Grinnell Ave., Detroit, Mich., to accommodate the Luers blades on six additional types of screw machines. One of the outstanding features of these holders is the speed and simplicity with which a cutting-off tool can be set up in the machine and the facility in removing the blade for resharpening and in replacing it in the original position without disturbing the set-up. Two unique cams hold the blade securely and rigidly in place which force the top

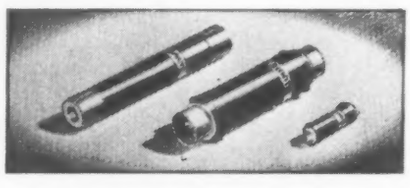
surface of the blade against the ground surface of the holder and provide a solid bearing. An arrangement on the locking wrench serves as a blade-setting gage and provides an efficient means for accurately resetting the blade after resharpening.

G.E. Crater Filler Used With Strikeasy Arc Welder

For use with Strikeasy arc welders the General Electric Co., Schenectady, N. Y., has introduced a new crater filler. This foot accelerator for welders provides very close auxiliary con-



trol of heat required in welding thin material and permits tapering off of the welding current at the end of a bead in order to fill the crater which is otherwise left. This unit is a combination of a foot-operated rheostat for reducing the current and a field forcing switch for providing a hot start or an increase in welding current when required that is instantly available, and the return to normal heat is instantaneous.



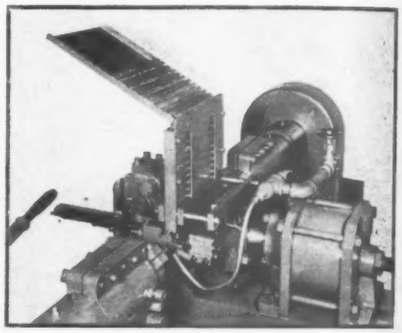
Ohmite Makes Ferrule Resistor Interchangeable Without Tools

A ferrule resistor designed for easy interchangeability without the use of tools has been brought out by the Ohmite Mfg. Co., 4835 Flournoy St., Dept. 5A, Chicago, Ill. An even winding of resistance wire on a ceramic core is protected by a vitreous enamel coating. The wire is terminated on metal bands which permit mounting in fuse clips. The ferrules are sleeve, cup or cartridge type.

Protective coatings which pass salt water immersion tests are available as well as special ceramic cores which, with special coating, will withstand the temperature shock test of repeated immersions from ice cold to hot water alternately.

Pines Engineering Profiler Adds Automatic Chute Feed

An automatic chute feed has been added to the air chuck on the two-spindle profiling machine made by the Pines Engineering Co., Inc., Aurora.



Ill. This attachment is being used for; feeding such items as brass and copper primer tubes for boring and tapping operations on both ends at the same time. Production has been increased by the addition of this automatic feed.

Lau Single Inlet Blowers Carry Off Hazardous Fumes

Single inlet blowers from 5 in. up to 9 in. in diameter for carrying away fumes and hazardous odors and to

bring in fresh air have been announced by Lau Blower Co., Home and Orchard Aves., Dayton, Ohio. This unit may be obtained with direct drive or with belt drive and is equipped with either a.c. or d.c. motors.

Francis Coating Machine Oils Both Sides of Sheet

A Model SPB coating machine has been brought out by the Chas. E. Francis Co., Rushville, Ind., for applying draw

SHAFTS OR SHELLS – *Faster!*

SUNOCO EMULSIFYING CUTTING OIL

helps machine better war materials . . . in shorter time

Whether it's shafts or shells, axles or "ack acks," Sunoco Emulsifying Cutting Oil is proving a production stimulant for all machining operations requiring an emulsifiable cutting oil.

Sunoco is increasing tool life. Exceptionally high heat-absorbing properties preserve the cutting edge of tools . . . permitting longer operating periods between tool grinds, fewer "time outs" for tool changes — more production per shift.

Sunoco is making possible greater feeds and speeds. Because of the excellent heat dissipation, increased speeds and feeds can be utilized on many operations . . . producing more pieces in shorter time . . . with no sacrifice in accuracy or finish.

Sunoco is reducing rejects. Maintenance of close tolerances, smoother finishes, fewer tool set-ups . . . all combine to cut rejects to a minimum.

Sun Doctors of Industry — experienced metal-working experts — are ready, willing and able to show you how Sunoco can speed your war production. Call one in today. For examples of how they are helping others, get your copy of "Helping Industry Help America." Write

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PERATION—Machining coupling from steel rging @ 98 R.P.M.

ACHINE — 2-L Gisholt Turret Lathe.

OLERANCE — .001".

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SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

W-S Standard Reamers with carbide tips. Tapered shank (illustrated) and straight shank types. Sizes: ¼ to 1½.

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available from stock

WE LIST as STANDARD many cutting tools formerly in the so-called "special" class. Better yet, the majority of these standard cutters is in stock most of the time. Our line is broad enough to often permit consolidation of tool orders thereby saving valuable time.

Cemented carbide tools are our *specialty.* We make them *exclusively.* Each tool is tipped with the *correct* grade of CARBOLOY best suited to do a cutting job on the metals for which the tool was ordered. (Other brands of carbide can be specified.)

You can expect and get uniform, high quality results with Wendt-Sonis tools. Catalog 142 mailed FREE upon request. Ask for it! WENDT-SONIS COMPANY, HANNIBAL, MISSOURI.

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W-S Carbide Tipped Core Drills available in straight and tapered shanks. Sizes: ½ to 1½.

W-S Carbide Tipped Centers available in Morse, Browne & Sharpe and Jarno Tapers.

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CARBOLOY CUTTING TOOLS

CENTERS ★ DRILLS ★ CORE DRILLS ★ COUNTERBORES ★ SPOT FACERS
END MILLS ★ REAMERS ★ HOLLOW MILLS ★ LATHE BITS ★ SPECIAL TOOLS

lubricant to steel sheets. It consists of two corrugated rubber coating rolls for coating the sheets on both sides. A doctor or scraper roll is used in conjunction with each coating roll to govern the thickness of spread and to form a roll crotch to hold the compound. If desired, the lower coating roll can be adapted to pick up its supply of mixture from a stationary or adjustable pan. Calibrated adjustments are used for governing the spread as well as for adjusting the opening between the rolls for thickness of metal. The drive of this coating machine is provided by a direct connected geared-head motor. The equipment can be furnished on a welded steel stand mounted on casters for moving to different positions and can be had in any width, in regular or extra heavy construction, bench or floor models, and for single or double coating.

National Carbide Portable Floodlight Has Many Uses

The NC-200 model portable floodlight has been announced by National Carbide Corp., 60 E. 42nd St., New York, N. Y. It is useful for night shifts to save delay in installing permanent equipment on construction jobs, and serves many other emergency uses. The unit has two 8,000 candlepower floodlights constructed on swing joints, thereby allowing independent directional control with 16,000 candlepower concentration of light. It may be used continuously or intermittently and is always ready for instant use until the carbide charge is exhausted.

Gibsiloy Facing Contacts Made in Laminated Metals

Gibsiloy contacts in laminated metals have been announced by Gibson Electric Co., Pittsburgh, Pa. These contacts are used as a facing on the contact surfaces where the electrical properties are used to best advantage and inexpensive base metal is used for backing material. Gibsiloy contacts are produced by special processing of metal powders which do not naturally alloy with one another. They are available in both inlay and overlay types, and furnished with Gibsiloy or with fine silver or other precious metal contact surfaces for a wide variety of contact applications.

McDonald Burt-Weld Lens Eliminates Torch Glare

A welding lens for aluminum welders called the Burt-Weld lens is being marketed by the B. F. McDonald Co., 1248 S. Hope St., Los Angeles, Calif., which completely eliminates the glare of the welding torch. It fits any standard welding goggle accommodating a 50 mm. round lens, and is scientifically ground, polished and optically perfect.

Paint Coating Speeded With Francis Roller Coater Machine

For applying a uniform paint coating to metal sheets the Chas. E. Francis Co., Rushville, Ind., has introduced the Model SPO roller coater machine. It is made with a coating roll and a mating doctor roll. The coating roll core is made of steel tubing, with steel end flanges and trunions welded in the ends. A durable composition cushion cover forms the applying surface. The trough for holding the coating material is the crotch formed between the coating roll and doctor roll. It is sealed at the ends by end-seal plates, which lift off easily by hand for cleaning.

Dial indicators are fitted in each of the adjustment hand wheels. An overriding clutch is built in the doctor roll as a protection for the cushion covering on the coating roll. It provides a positive drive for the doctor roll and also permits it to be carried at the faster surface speed of the coating roll in the event that actual contact is made. The main drive is through a vari-speed motodrive. The speed of the roller coater varies from 20 to 60 ft. per min.

Ellstrom Internal Setting Gage Saves Checking Time

The Ellstrom internal setting gage, announced by the Dearborn Gage Co., Dearborn, Mich., is suitable for use in a vertical or horizontal position. Its gaging surfaces are processed and finished to millionths in flatness, making possible minimum adjustment in checking. The gage covers readings up to 6 in. The base measures 4x6½ in., and the overall height is 12 in. It is supplied with a solid walnut case hinged at the top and front.

Robinson Specialty Tack Rag Cuts Cleaning Time Before Painting

A professional tack rag, the O-U-Tack, that eliminates the use of solvents and saves time in cleaning dust and overspray prior to painting, has been announced by the Robinson Specialty Mfg. Co., 816 W. 5th St., Los Angeles, Calif. It is flexible as to tackiness and does not dry out in storage. More tackiness can be secured by applying heat, less tackiness by drying in the open air. It is said to be particularly applicable when preparing aircraft skins for synthetic enamel as it completely removes metal dust and other minute particles developed in drilling and riveting.

Lockformer Rolling Machine Forms Strips in One Operation

Metal strips can be shaped in one operation on the Lockformer Model S10 rolling machine manufactured by the Lockformer Co., 4613 Arthington St., Chicago, Ill. which accommodates two sizes. Flat strips of sheet metal, 20 gage, are fed to rolls on either side of

Sets Record Cutting Stainless Steel Pipe

Since this manufacturer shifted to Technite power hack saw blades, he reports fewer broken blades and longer cutting life. The cost of cutting stainless steel pipe has been lowered. You can achieve similar savings . . . by ordering Capewell's Technite blades from your mill supply man.

THE CAPEWELL MFG. CO., Hartford, Conn., U. S. A.

CAPEWELL

THE TREND IS TO TECHNITE
THE MOLYBDENUM HIGH SPEED HACK SAW BLADE

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RADIUS GAGES

EASY TO USE . . .
FIVE APPLICATIONS . . .

Because each blade in the Lufkin Set of Radius Gages is a separate unit, it can more easily and accurately be applied to the work. The other blades can't interfere in any way. Each blade has five separate applications of its individual radius—and carries the corresponding external and internal forms. The durable leatherette folder is arranged for most convenient handling of complete set, and the Lufkin Gage Holder (supplied for slight additional cost) is ideal for working in those hard-to-get-at places.

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LUFKIN

SAGINAW, MICHIGAN · NEW YORK CITY
TAPES · RULES · PRECISION TOOLS

the forming head. The strips emerge from the forming head in one operation. Production is at the rate of 40 ft. per min.

Rolls on the right side of the machine make a finished strip 2⅜ in. wide and rolls on the left side produce a strip measuring 2 in. wide.

NEW MATERIALS

"Speedi-Out" Extinguishes Magnesium Fires and Bombs

A product known as "Speedi-Out" has been developed by Waverly Petroleum Products Co., Philadelphia, Pa., for extinguishing magnesium fires and bombs. It is a hard coal tar pitch which is non-abrasive, non-toxic and non-corrosive, and has a 6/35 mesh with a softening temperature exceeding 300 deg. F. This product operates by cutting off completely the supply of oxygen. "Speedi-Out" can easily be chipped off when dry thus salvaging the property to which it has been applied. It is furnished in 100-lb. burlap bags.

Flame-Resistant Insulating Varnish Developed by Sterling

A flame-resistant insulating varnish, designated as R-878, which is recommended for class B high temperature insulation has been developed by the Sterling Varnish Company, 105 Ohio River Blvd., Haysville, Pa. This varnish is mechanically strong and dries all the way through when applied to electrical apparatus. After drying it will not support combustion, when the flame is removed, neither will it melt nor resoften under operating temperatures. In addition to good heat resisting qualities, it has all the characteristics of high-grade insulating varnishes.

Cortland Emery Aggregate Produces Non-Slippery Floors

Cortland emery aggregate, a mixture of scientifically graded large, small, sharp and hard particles of mineral emery has been brought out by Walter Maguire Co., Inc., 330 W. 42nd St., New York, N. Y., which is designed to produce non-skid floors, either dry or wet. The aggregate is mixed with cement and water for the floor topping. The gripping action is claimed to improve as the cement wears away and the emery particles become exposed. The floor mixture will support a load of more than 14,000 lb.

Turco Stripper Paint Remover Made Non-Inflammable, Wax-Free

Development of a non-inflammable paint remover designated as Turco Stripper L-595 has been announced by Turco Products, Inc., Dept. 1, 6135 S.

Central Ave., Los Angeles, Calif. This is a fast-acting, wax-free remover in which the "lifting action" begins almost immediately upon application. It can be used with complete safety near welding machines, electrical apparatus, grinding wheels and other equipment which generate heat and sparks. It is claimed that this water-white liquid will not injure polished aluminum alloy, anodized aluminum alloy, alclad, cadmium plated and stainless steels or polished copper. The remover is applied with a brush or spray and no after cleaning is necessary.

TRADE PUBLICATIONS

AVIATION EQUIPMENT The Lyon-Raymond Corp., Greene, N. Y., offers a 10-page catalog entitled "The Answer to Production and Servicing Problems in the Aviation Industry."

BEARINGS Selflube porous iron bearings are described in a four-page folder issued by the Keystone Carbon Co., St. Marys, Pa.

BLOWERS A 20-page bulletin, 22:23-B-11, issued by Roots-Connersville Blower Corp., Connersville, Ind., contains numerous installation views and details of construction of rotary positive blowers.

CHART To reduce repair time of electrical apparatus for industrial and central station use, a pasteboard maintenance chart, 16½ × 21½ in., for posting on plant bulletin boards, is available upon request to Department 7 N Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

CLEANING A 40-page manual covering all essential phases of cleaning required in aircraft production and maintenance has been issued by Oakite Products, Inc., 24 Thames St., New York, N. Y.

CONVEYORS A 35-page catalog, A-72 prepared by Richards-Wilcox Co., Aurora, Ill., illustrates and describes the new R-W power drive conveyor.

DERMATITIS The causes and prevention of dermatitis in the metal working industry are discussed in a folder prepared by the Metal Research Staff of E. F. Houghton & Co., Philadelphia, Pa.

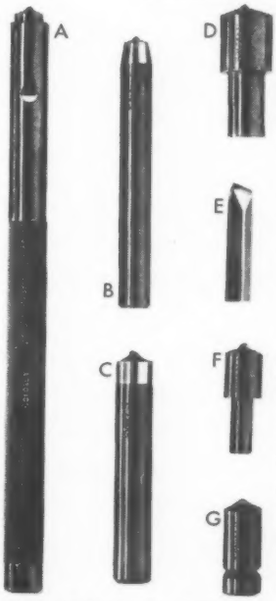
ELECTRICAL CONNECTORS The 48 pages of the Pocket Catalog published by Burndy Engineering Co., Inc., 107 Eastern Blvd., New York, N. Y., contain important features of electrical connector types.

HOISTS Catalog No. G-6 published by Coffing Hoist Co., Danville, Ill., contains information and specifications on

NOW Clutsom Machines · Inc. Introduces
INDUSTRIAL DIAMONDS THAT REMAIN SET

COLDSET PROCESS:

- Reduces costs...no loose stones.
- Eliminates frequent setting...firm and uniform support.
- Casings in high-carbon steel, stainless steel and Monel metal.



Standard types shown above: (a) Toolmaker's Hand Tool, (b) George Scherr, (c) Brown & Sharpe, (d) Cincinnati, (e) J&L Special, (f) Small Landis, (g) Norton.

The COLDSET process, wherein during the setting the diamond is protected from harmful heat, pressure or shock, renders obsolete the makeshift methods heretofore used for the casing of industrial diamonds. COLDSET diamonds will not loosen or pull from their settings even under the most severe usage.

COLDSET diamonds are set in high-carbon steel, stainless steel or Monel metal. The latter is generally used since it eliminates the possibility of soft oxides forming about the stone, with possible loosening from this cause where coolants are used.

Let us show you how to reduce costs resulting from broken or lost stones and eliminate the necessity for frequent resetting. You'll never find a COLDSET Diamond in a water reservoir or sediment pan.

COLDSET DIAMOND TOOL CO.
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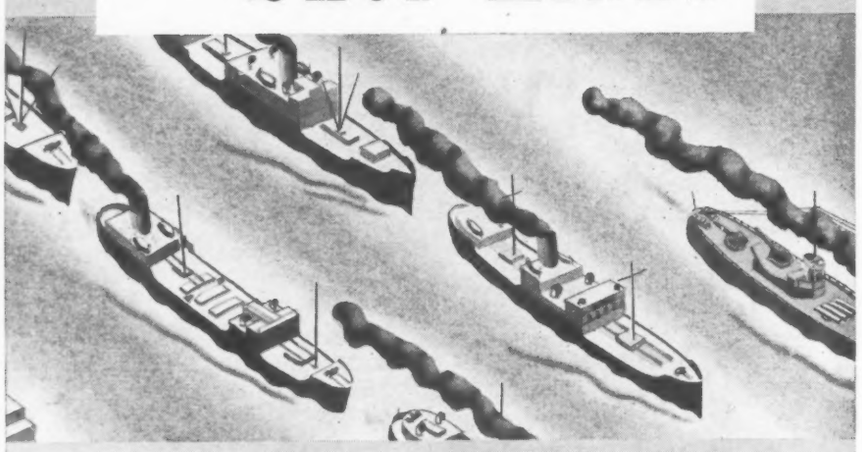
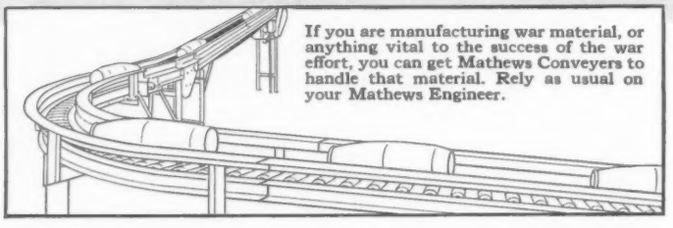
SHIP LANES *and* SHOP LINES



. . Both Must Be Kept Open!



If you are manufacturing war material, or anything vital to the success of the war effort, you can get Mathews Conveyers to handle that material. Rely as usual on your Mathews Engineer.

● MECHANIZED SUPPLY LINES WITHIN THE SHOP have solved many war production problems. Where well planned Conveyer Systems have been installed, not only have shop and assembly lines been kept open . . . they have been greatly accelerated . . . machine-and-man-hour production has been improved . . . worker fatigue has been reduced! Mathews Engineers are working every available hour toward the improvement of American war production.

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ratchet lever hoists, electric hoists, spur geared chain hoists, differential chain hoists, I-beam trolleys, load binders and utility maintenance tools.

HYDRAULIC MACHINERY "Industry's New Right Hand for Positioning, Pushing, Pulling, Pressing, Clamping and Lifting" is the title of Bulletin No. M-5 issued by The Denison Engineering Co., 1160 Dublin Rd., Columbus, Ohio.

LIQUID CONTROL SYSTEMS A 40-page illustrated catalog describing liquid control systems has been published by S. F. Bowser & Co., Inc., Ft. Wayne, Ind.

MAINTENANCE A two-volume set of maintenance rules and suggestions, totaling 220 pages and made up of 15 chapters for loose-leaf insertion in 5 x 7-in. binders, is available to maintenance men from Department 7-N-20, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MANGANESE STEEL The American Brake Shoe & Foundry Co., 389 E. 14th St., Chicago Heights, Ill., has prepared a 24-page bulletin, No. 642-C, illustrating and describing Amsco manganese steel for crusher, grinding mill and pulverizer parts.

PUMPS Catalog No. 38-P, a second edition of "Handbook on High Vacuum Practice and Vacuum Pump Catalog," is offered by F. J. Stokes Machine Co., Tabor Road, Philadelphia, Pa.

TRUCKS "America's Trucks—Keep 'Em Rolling" is the title of a booklet prepared by the Vehicle Maintenance Section, Division of Motor Transport, Office of Defense Transportation, Washington, D. C.

NEW BOOKS

MACHINE SHOP PRACTICE—*By Sherman B. Hagberg in collaboration with Murlan S. Corrington, and Raymond N. Biehler, Rochester Athenaeum & Mechanics Institute. 311 pages. Ring building. Published by Harper & Bros., 49 E. 33 St., New York City.* $2.50.

This volume is designed to serve as a practical working manual for students in machine shop work. It contains a sequence of projects graduated progressively in accordance with the degree of skill required.

The exercises were evolved through ten years of use in the machine shop of the Rochester Athenaeum & Mechanics Institute. In compiling this book, the authors were assisted by a committee of advisory editors and by the executives of several Rochester industrial plants.

While the material covered by this volume does not differ greatly from that in similar manuals, the projects themselves have been well selected with an

eye to practical application. For example, the chapter on taper work calls upon the student to make a V block, having both external and internal V's and two straight slots.

Emphasis is placed on both hand and machine work. The concluding chapter is devoted to punches and dies, and includes a brief bibliography.

•

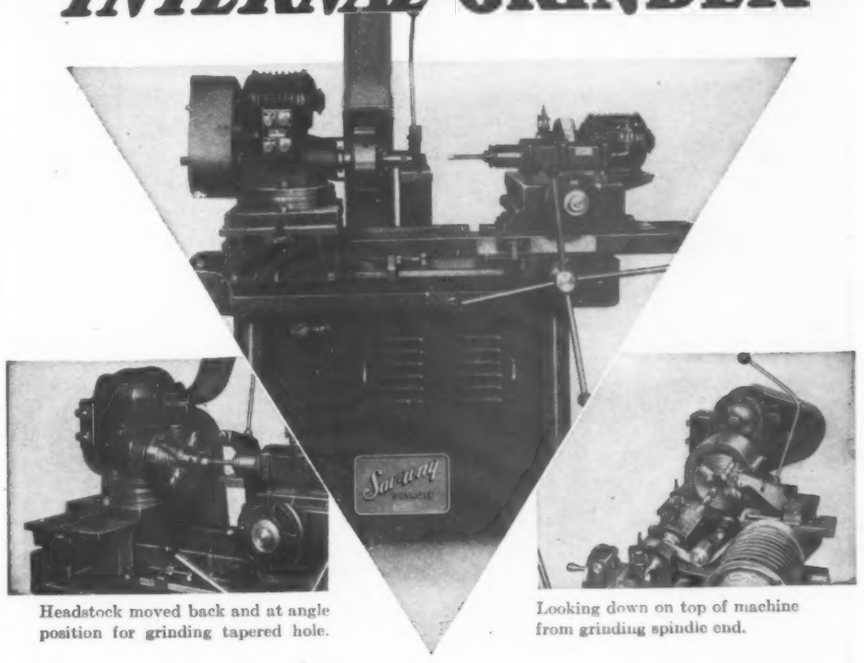
AMERICAN STANDARD DEFINITIONS OF ELECTRICAL TERMS—*Sponsored by American Institute of Electrical Engineers. 311 pages. Published by American Institute of Electrical Engineers, 33 W. 39 St., New York, N. Y. $1 in U.S.A., $1.25 outside U.S.A.*

The new American Standard known as "Definitions of Electrical Terms, C42," sponsored by the American Institute of Electrical Engineers, and approved by the American Standards Association and the Canadian Engineering Standards Association, is now ready for general distribution. This is the first time the definitions of the important terms common to all branches of the art as well as those specifically related to each of the various branches have been assembled and printed under one cover. The glossary is the result of more than twelve years' work of a sectional committee of 46 members having 18 subcommittees drawn from available specialists. More than 300 individuals have given material assistance and many others have assisted in specific instances. The 34 organizations represented on this sectional committee include the national engineering, scientific and professional societies, trade associations, government departments and miscellaneous groups.

The primary aim in the formulation of the definitions has been to express for each term the meaning which is generally associated with it in electrical engineering in America. The definitions have been generalized wherever practicable to avoid precluding the various specific interpretations which may be attached to a term in particular applications. It has been recognized that brief, simplified phrasing usually presents the clearer word picture. Amplifying notes accompany certain definitions when the added information is particularly helpful, but those notes are not a legitimate part of the standard phrasing. Words used in the definitions have been employed in the accepted meaning as given in the recognized dictionaries, unless they have been defined specifically in this glossary. Specialized definitions for common words have been discouraged.

Prior to the inception of this work the definitions to be found in the literature of the electrical art were comparatively few, were very widely scattered and their formulation as to substance and expression was generally the work of individuals or small groups. Many of these had gained some measure of approval in that branch of the art responsible for their formulation, but were practically unknown

Saw-way MULTI-PURPOSE INTERNAL GRINDER



Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

Offers greater flexibility . . . a precision grinder, designed and built by engineers with years of practical experience to guide them . . . has a headstock traverse of 6″ . . . grinds holes ¼″ to 18″ in diameter . . . holes up to 9″ deep, straight or tapered . . . entire headstock may be moved at right angle to wheel traverse, by merely loosening two conveniently located nuts . . . worm compensating device permits grinding wheel head adjustment to .0001 . . . sturdy construction throughout . . . full specifications, delivery time and price on request.

Distributors throughout the U. S. and Canada to serve you.

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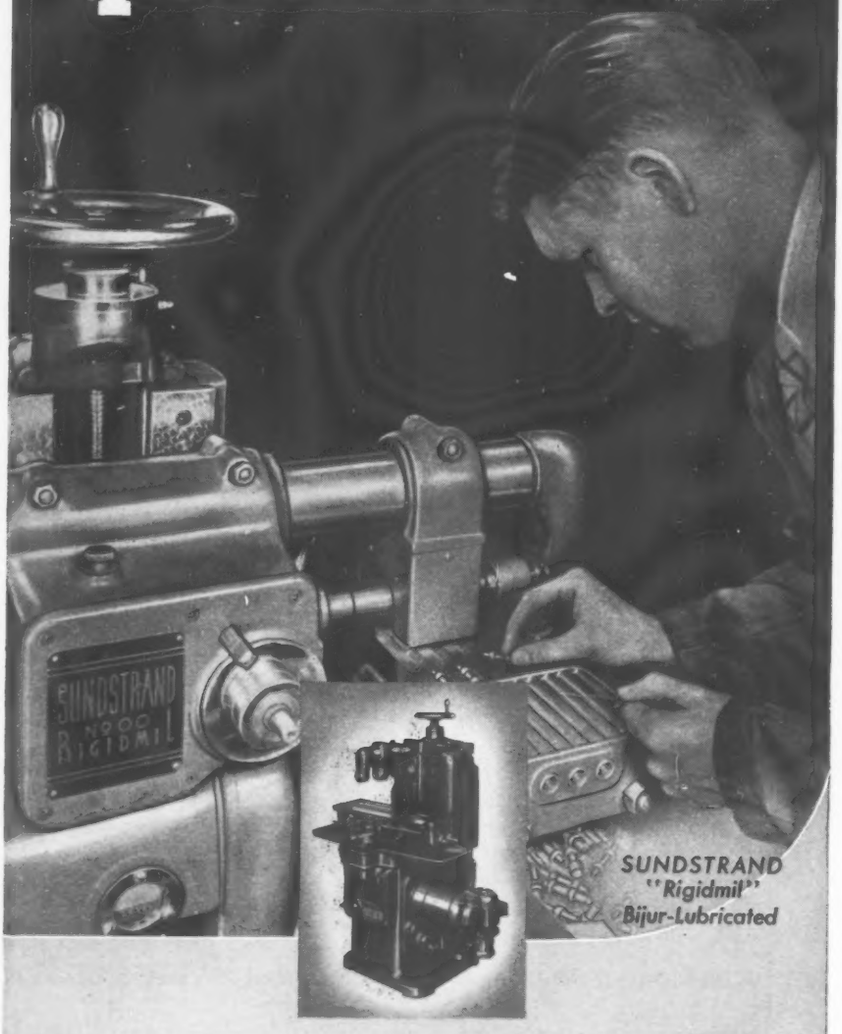
HIGH SPEED **protection . . .**



■ With industry geared to a constantly increasing tempo, high production rates must be maintained over long periods of time. Long runs, multiple shifts, extended hours . . . these and other emergency conditions make efficient lubrication all the more essential. BIJUR automatic "metered" lubricating equipment is doing its part in assuring quality production at top speeds.

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elsewhere. Some groups of general terms had long been the subject of much controversy.

This new American Standard has unified and perfected the existing groups of definitions and has rounded out these groups and added many new groups. Its coverage is more than three times that of this field in any other language. It should prove of great value to the general public as well as to scientists and engineers for it is an extension of the function of the recognized dictionaries into specialized fields not hitherto covered.

TO THE EDITOR

Fair Play

Dear Sir:

There has been a tendency of late, and rightfully so, for everybody to make all sacrifices in order to insure final victory for the United Nations. However, in order to insure this ultimate victory it is necessary to get the complete cooperation of every machine shop owner whose machinery and mechanical ability are an essential element in the final result.

These men, for the most part, are expert tool and die makers who produced certain articles for various industries during normal times. Today, because of the emergency, they are compelled to purchase additional machinery to be in a position to bid on war work. This, in most cases, necessitates a substantial cash outlay, which is usually done under very trying conditions. When this additional equipment is purchased, these owners often find themselves forced to accept subcontracts from prime contractors with little hope of ever being compensated for the additional investment. The prime contractor, in most instances, due to his convenient set-up agrees to do a job for a certain price, whereas his subcontractor, the small machine shop owner, is called in to help when the prime contractor becomes bottlenecked because of the present increased demand for war work. The small man is pleased to cooperate in every way even though these tail-end jobs require setting up of the machinery, a costly operation seldom appreciated by many prime contractors. The immediate solution to this problem is the handling of the question of remuneration in a more equitable manner.

There are many exceptions to this prevailing condition, and particularly one with which the writer is more familiar. In this instance, we find a factory located in Brooklyn proudly displaying its "E" rating banner. The duty of allocating subcontract work is ably supervised by a gentleman who, by reason of his ability to understand existing world conditions, manages to maintain the fine standard established by his employers, at the same time satisfying those subcontractors who are pleased to cooperate with him in his

important work. Our hats are off to such establishments and to those men who so ably uphold the great principle of fair play.

A proper way to solve this perplexing problem would be to either emulate the example set by the above-mentioned corporation, or for duly constituted government agencies to inspect these small shops in a thorough manner, followed by an appropriate order for the work best suited in each instance at a price to insure proper results. Unless some step is taken very soon, many of these shops will be forced to shut down, thus compelling these expert mechanics to accept jobs elsewhere. As a result, many a young man who has completed his course of academic training sacrifices to a great extent his opportunity to work for one of these machine shops where he acquires valuable practical experience.

Very truly yours,
LAWRENCE LIPKIN

Plastic Handwheels for Machines

Dear Sir:

In observing the cast-iron handwheels, many of which are heavy and all of which are smoothly machined, with which production machinery is equipped, I believe that plastic automobile steering wheel material and construction could be substituted. Certainly a wheel dependable for controlling a car would be strong enough to set dial readings. The idea may, perhaps, be applied to many other machine tool parts.

Very truly yours,
EDWARD HEBERT,
Bell Aircraft Corporation

Spare the Skilled Mechanic

Dear Sir:

After working steadily in an ordnance plant steering able and willing but new men into different phases of close tool work, it somewhat irks me to be four months in an army camp as a room orderly (janitor) barred from promotion because of health and unable to use 20 years of mechanical experience of the highest type. I have an idea that many other men also would be found of greater use in the toolroom than in whatever they are doing in the army. The army justly wants men below 30 years of age. A half-day observation at a training camp and discussion with training officers will make abundantly clear why: endurance.

As a labor policy, why is the very physically able young man being trained today except in army pursuits when older and less desirable men already experienced are placed in the army? I believe from observation that there is common ground between the demand of the army for the fit fighter and the desire of industry for the experienced man of over 30. I believe that with the judging eye it has, the army command would make an ally

FATHER TIME GETS JOLT

During the last twelve months, Father Time has been given one of the biggest jolts he has ever had to take.

American Industry is beating time. It is demonstrating that it can turn out *more* production, and *better* production, *faster*, than any other country in the world. Planes, tanks and guns are now rolling. Ships, large and small, are now sliding off the ways. Make no mistake about that.

But the demands placed upon the productive system of this country are incredible. America has been asked to furnish the four corners of the world with the equipment it takes to win this war. And that equipment is desperately needed now. Not next week. Not next year . . . but right now!

Let's line up everything we have, 100 per cent, for seven days a week, 24 hours a day, maximum production!

Geo. D. Trundle Jr.

P. S. Main job of our organization today is *conversion*.

THE TRUNDLE ENGINEERING COMPANY
Consulting Management Engineering

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ROEBLING *Wires*

ROUND . . . FLAT . . . SHAPED

A FEW WIRES TYPICAL OF ROEBLING'S BROAD SPECIALTY PRODUCTION
FOR A WAR-BOUND PRODUCT'S TOUGH SPOTS!
FLAT WIRE TO SPECIFICATIONS
SHAPED WIRES
REINFORCING WIRE FOR RUBBER TANK TREADS

America's mechanical monsters walk on rubber tires that have a backbone of Roebling Wire. Flexible enough to bend sharply with each turn of the driving wheels . . . tough enough to keep body and soul of the tread together.

Making steel wire for tough jobs like this is a specialty. It's typical of the new wire-at-war requirements that Roebling is meeting with new exactness of control—in steel analysis, temper, grain structure and dimensional tolerances.

If your production schedules call for round, flat or shaped wires to *exacting specifications*—team up with Roebling, we have the know-how and facilities to meet your standards. Prompt action on war orders.

JR ROEBLING

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY · Branches and Warehouses in Principal Cities

of the manufacturer on such an issue. The army hopes but does not fully expect that the older man will keep up with the younger boy.

The army may eventually use six million men, youngest and best first, then those who have newly become old enough, and then if, and only if they need them, the older men. If the war is long, then the older man will not be long used in the army and newer crops will arrive for duty as the hand of time moves them. I believe that the operation of "Father Time's" scythe is being ignored in this army duty matter by all but the army.

ANONYMOUS

Increase Operator's Output

Dear Sir:

While reading the article on the machining of percussion fuzes in *AM* —Vol. 86, page 458, I was immediately struck by the awkward position of the girl operator in the lower illustration.

The spindle operating lever is placed so far above her head that it is necessary for her to reach for it in a manner that must prove very tiring before the day's work is completed and there is no doubt but what this results in lowered output. It would appear that it would not be impractical to arrange an auxiliary hand lever attached to an angle plate clamped to the drill press table and connected with a link to the regular lever.

The auxiliary hand lever and connecting link could be provided with a number of holes for a suitable pivot pin so that the hand lever could be adjusted to suit operators of varying size and reach. With such a hand lever properly adjusted I feel confident that an operator's output would be considerably increased.

This means she would come to work the next morning in a more cheerful frame of mind and everybody would be happier. Let's think of the operator's comfort as well as her output. They are generally tied pretty closely together.

Very truly yours,

L. DEL. BERG

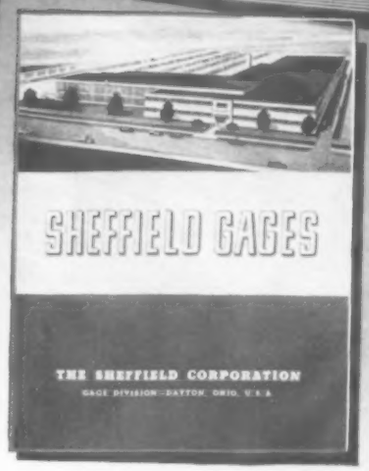
Salt Combats Heat Sickness

Research has shown that loss of salt from the body through excessive perspiration is the source of heat sickness of workers at machines and benches, particularly those engaged in hot, heavy work, during hot weather. Unless salt is present in proper quantities the various parts of the body cannot hold the necessary amount of water.

When body salt is lost through excessive sweating and not replaced promptly, cells and other parts of the body lose water which upsets the chemical balance. If the salt loss is slight, the worker will be tired and have a letdown feeling. However, when this upset condition is allowed to continue

Check internal diameter quickly and accurately at the
SHEFFIELD PRECISIONAIRE
SHEFFIELD ELECTRICHEK
Save inspection time by checking any number of dimensions at once
the SHEFFIELD MULTICHEK
SHEFFIELD Visual Gages

ONE OF THESE BOOKLETS *may break that inspection bottleneck*



Here are five booklets covering many of the types of Sheffield Gaging instruments. They present some of the most important advancements in the gaging art.

One of them may break that inspection bottleneck—improve your inspection practices—lower your costs.

"SHEFFIELD PRECISIONAIRE"—Describes the most modern air gage for checking all types of bores including long, inaccessible bores such as rifle barrels. Little skill is required to operate the Precisionaire—high accuracy and speed are obtainable by any operator with minimum training.

"SHEFFIELD ELECTRICHEK"—Describes the Electrichek, a fast, accurate gage for high production. Particularly useful where inspectors must be recruited from less skilled workers.

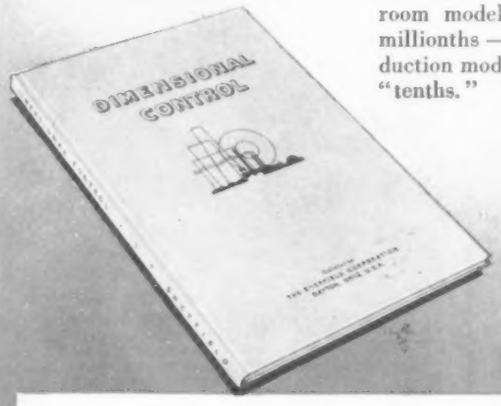
"SHEFFIELD VISUAL GAGE"—Describes a gage of wide range of usefulness—available in laboratory or tool room models, reading to millionths — and in production models reading to "tenths." Very easy to operate—extremely rugged in construction.

"SHEFFIELD MULTICHEK"—Describes the fastest and most useful gage available for checking several dimensions at once. The Multichek is relatively simple to set up—very simple to operate after setting. Widely used on shells, fuses, ordnance parts, etc.

"SHEFFIELD GAGES"—An 8-page digest of the Sheffield line of instruments; this booklet should be in the file of every key person concerned with gages and inspection. Included are descriptions of the gages mentioned previously, as well as the Sheffield Thread Lead Checker, the Sheffield Universal External Measuring Instrument, and the Sheffield Universal Internal Measuring Instrument.

"DIMENSIONAL CONTROL"—"Dimensional Control" is a new basic text on gages and their use in industrial inspection. It has been written for Engineering students, members of Defense Training Courses, and men in Industry who want a more complete knowledge of this phase of their work.

This is a 64-page book carrying 82 illustrations. It is 7¾" x 10⅝" with a special stiff cover and cloth binding—price $1.50 postpaid.



Write for one or more of these booklets that interest you.

★

THE SHEFFIELD CORPORATION • DAYTON, OHIO, U. S. A. • Dept. "A"

Please send me copies of the bulletins checked below free.

- ☐ Sheffield Precisionaire
- ☐ Sheffield Electrichek
- ☐ Sheffield Visual Gage
- ☐ Sheffield Multichek
- ☐ Sheffield Gages
- ☐ Send also a copy of *Dimensional Control* for which find my remittance ($1.50) attached.

Name_____

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FOR *accuracy*
CADILLAC
THREAD
PLUG GAGES

As specialists, we manufacture thread plug and ring gages for checking National, Whitworth and special form threads from your smallest size requirements to six inches in diameter. Special thread checking fixtures and thread alignment gages are built to customer's design. Orders and re-orders from the largest armament manufacturers testify to the accuracy of CADILLAC Gages. *Let us serve you! !*

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AND OTHER THREAD
CHECKING EQUIPMENT

Cadillac
OF
DETROIT

actual heat sickness and muscle cramps occur.

This salt loss should be replaced at the same time and in the same ratio as the loss. Because the body does not store away extra quantities for future use it is necessary to get a certain amount each day. The average person can obtain the necessary daily quota from the salt used in seasoning his food, but workers engaged in heavy work or long hours must have additional salt to compensate for the loss through sweating. Since workers in even the hottest jobs seldom drink more than 2 gal. of water during an 8-hr. day, the extra quota required is approximately two level teaspoons, which is about 60 percent more than the average diet contains. Workers not engaged on hot jobs generally consume from 2 qt. to 1 gal. of water during the day and need half to a full teaspoon of salt, or 10 to 25 percent more than the salt content of the average diet.

Some plants supply salt to the workers by adding the proper percentage to the drinking water, and another method which is becoming increasingly popular is the placing of salt tablets in machines convenient to drinking fountains or on water coolers. As the production pace grows faster and the days become hotter it is increasingly necessary to maintain the worker's fitness and efficiency in order to avoid any summer slump. Common salt has been found one of the most effective weapons against hot weather letdown.

Vultee Finds Women Are Able Workers

Vultee recently completed its first year of manufacturing experience involving the use of women on direct production jobs. We were the first military aircraft manufacturers in the United States to begin the employment of women in the shop.

During April of last year, Vultee put to work the first 50 women, using them in the radio and electrical subassembly department. Several were hired on preparatory jobs, such as masking, in the paint shop and on the sewing of fabric covering for control surfaces and blind flying hoods. By the end of the first month these women had proved conclusively that they were capable of handling a large number of the jobs involved in large-scale production of military aircraft. Several hundred additional women have been added to the payroll in ensuing months.

On the basis of a recently completed survey, we have concluded that the present total of women employees in the plant can be quadrupled, if need be, and the total number of job classifications for which they are hired can be more than doubled. Considering draft conditions, with an eye to which I may say the program originally was started, the advantage of this is obvious.

In Grinding
DON'T OVERLOOK
THIS VERY
IMPORTANT FACTOR!
Stuart's
CODOL
Liquid Grinding Compound

100% grinding efficiency is best accomplished by careful consideration of the grinding fluid factor. The vital part which a properly applied, specialized grinding lubricant plays is too often overlooked. It can mean unnecessary sacrifice in quality of finish production speed, and cost of wheels.

These handicaps can frequently be eliminated by going over your grinding problems with a STUART OIL Engineer. His highly specialized experience in the application of modern grinding fluids will help you secure top efficiency.

ASK FOR this informative booklet. Free working sample upon request. Please send your name on Company Letterhead.

For All
Cutting Fluid Problems
D. A. STUART OIL CO.
LIMITED
Chicago, U.S.A. Est. 1865
Warehouses in All Principal Metal Working Centers

Our first problem was with the men. They resented what they considered to be an encroachment of women upon their sphere. They sought to belittle the notion that women might successfully fill jobs similar to the ones on which they worked. Of further injury to their masculine pride was the fact that Vultee committed itself to the payment of wages in direct relation to the job done—making no distinction in wage scale between men and women.

Men Trained for Better Jobs

Here, then, was a situation in which men found themselves working shoulder to shoulder with women, on similar jobs and receiving similar pay. Since there was little else they could do about it, the men awoke to the realization that the only way out was "up". For the most part, they began to train themselves for better jobs. This reaction fitted admirably into the company's program of expansion. It was never Vultee's plan to replace men with women, but rather to employ women in order that available men could be released to fill jobs requiring greater capacity.

The radio and electrical subassembly department in particular had been a continuous problem so long as men were employed there exclusively. Most of the tasks involved routine repetitive operations. Men quickly learned them and, as quickly, became dissatisfied. They wanted more money than the job was worth. Failing to get it, they demanded transfers to other departments. Specifically, they lost interest in their work.

Since the company was pursuing a course of rapid expansion, opportunities for advancement to better positions were seldom lacking. By reason of this, our problem with the men practically solved itself.

Meanwhile, women were being inducted into the plant in increasing numbers. They were put to work in the machine shop, doing filing and burring. Then they were tried, and found competent, in the operation of drill presses, and on mills, hand turret lathes, and similar tools.

Jobs Tailored for Women

Factory jobs for women must be tailored to women. By reason of general usage, the tools and facilities of American factory jobs largely are designed to be handled by men.

It was in Vultee's favor that the hiring of women was started when production jobs were being simplified to meet the needs of fast, quantity production. Consequently it was a comparatively simple problem to so plan many of the jobs that they can be said to be tailormade for women.

Throughout the electrical subassembly department, operations are arranged so that women may sit at their work, with all materials and tools close at hand.

Special jigs were added to hold small tools, such as drills, so that women could concentrate on employing more

Wyckoff ENTERS THE
THIRD YEAR OF VICTORY PRODUCTION

●Nearly three years ago . . . even before Lend-Lease was a reality . . . Wyckoff Drawn Steels were supplying much needed precision and accuracy in large volume to the defenders of Democracy.

Today 100% of Wyckoff's capacity is serving the United Nations' War Production Program . . . producing uniform quality, fast-working, cold drawn steels . . . the result of more than 25 years of "know-how" and nearly three years of military specification experience.

The All Navy "E" Burgee, proudly flying at both Wyckoff plants, is a constant reminder to us of still greater goals ahead!

WYCKOFF DRAWN STEEL COMPANY
FIRST NATIONAL BANK BLDG., PITTSBURGH, PA.
3200 SOUTH KEDZIE AVENUE, CHICAGO, ILL.

Manufacturers of Carbon and Alloy Steels . . . Turned and Polished Shafting . . . Turned and Ground Shafting . . . Wide Flats up to 12" x 2"

★

DEPENDABLE PRODUCTION

Many Ross air control valves have been in continuous use for more than fifteen years. . . . They constitute your assurance of dependable plant operation . . . today . . . tomorrow . . . and years in the future.

Bring your air control problems to

ROSS *Operating* VALVE CO.

6489 Epworth Boulevard

DETROIT, MICH.

effectively their proven capacity for repetitive operations requiring high digital dexterity. They excel at making every movement of the hands count.

This retailoring of jobs to suit them for women has extended amazingly the list of job classifications in which women have proved themselves proficient. But the extent to which it could be carried struck definite limitations when it was sought to segregate women into sections of the plant separate from those in which men were required.

Insofar as it was possible, that effort was carried out. But efficient warplane production, by a streamlined flow from raw stock to fly away, without backtracking does not permit such an idea to be carried very far. Many of the jobs for which women are admirably suited must be carried out by them shoulder to shoulder with men.

Equality of Treatment

It was essential, therefore, from the outset, that men and women be treated with equality. With but the few exceptions mentioned, (and those desirable to best efficiency of both), this policy has been carried out explicitly. Results have been most encouraging. Having proved their ability to hold their jobs, being paid on the same wage scale and treated the same as men, women began to react to their own competence. They gradually began to accept an equal share in plant activities.

Women's suggestions repeatedly have led to their own increased efficiency. They have applied their knack for contriving ways of doing things more quickly and with less effort. One has designed a new type of rack on which light parts are conveyed from subassembly to the paint shop and supported during paint spraying operations. Another developed a means of sewing tail wheel boots that saves valuable material and time. Yet another drew upon her previous experience in a bottling works to suggest the use of a glue spreading machine to replace the former method of applying adhesive with a brush. By doing so, she multiplied her own production three times. A woman employee in the paint shop developed a means of masking which saves masking tape and can be used more quickly.

If I am right in assuming that the effect of women being inducted in large numbers into war industries is reflected by results at Vultee, it seems not unreasonable to point out that development of this new source of war labor supply—by which half, or perhaps more than half of direct war production may be carried (if that becomes essential to victory)—may culminate, sometime in the future, in an industrial revolution.

Women, I believe, are here to stay.

Abstracted from a talk by W. Gerard Tuttle, director of industrial relations, Vultee Field Division, Vultee Aircraft, Inc., at a conference on "Manning and Managing Our Arsenal" at the California Institute of Technology.

Mechanical engineers skilled in Precision products' design

and fine lathes like these Pratt & Whitneys

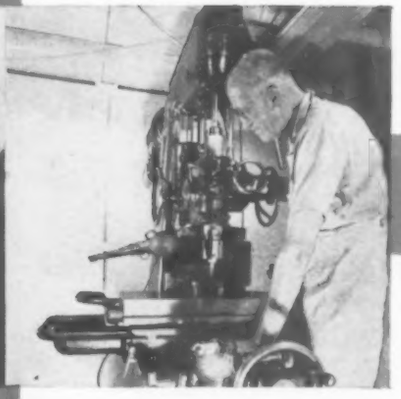
PLUS

Grinders such as this Thompson Surface Grinder

or this Jones & Lamson Precision Thread Grinder

PLUS

Machines for fine internal grinding like this Bryant Internal Grinder



and such modern tools to handle special tasks as are possible on a Pratt & Whitney Jig Borer

PLUS

Minute Inspection of all production on equipment like this Bausch & Lomb Comparator

and craftsmen of uncommon ability, like Fred D. Williams, precision machinist, concert violinist

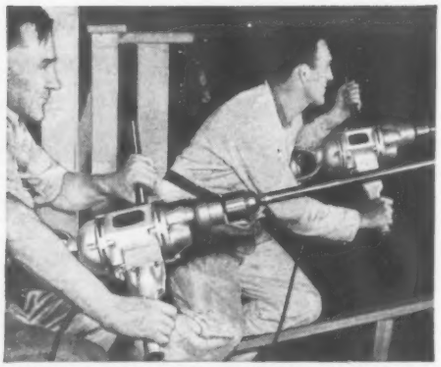
EQUAL

Aircraft hydraulics, special taps, inspection gages, lathe compounds, navigation instruments.

VARD INC.

PASADENA, CALIF., U. S. A.

Precision optical goods, vacuum evaporation treatment of lenses and mirrors, dividing engines.



HERE'S AN UNUSUAL DRILLING OPERATION on the frame of a PT Boat, details of which we can't disclose. But whatever the operation, B & D Heavy Duty Drills provide plenty of power for fast, accurate, continuous production work.

HOLGUN AND SCRUGUN, a perfect production team in the hands of skilled Elco builders; used for drilling, countersinking and screw driving operations—repeated *thousands* of times over the surface of each PT Boat.

HERE'S ELCO'S ELECTRIC TOOL ROOM, well-equipped with Black & Decker Electric Saws, Drills, Screw Drivers, Nut Runners and Sanders. Several hundred Black & Decker Electric Tools now are in constant use at the Elco yards.

How a Black & Decker Distributor

Helped Elco Build PT's Faster

WHEN the Electric Boat Company got a Navy Contract for Patrol Torpedo Boats, they needed tooling advice quickly! They called in George Carstens, Sales Engineer for Topping Bros., a Black & Decker Distributor.

Mr. Carstens worked closely with J. A. Guttridge, Elco's Shop Foreman, to perfect the tooling program for mass production of PT's: Black & Decker Electric Saws for ripping, notching and trimming; Heavy Duty Drills and Nut Runners for heavy wood boring and bolting in framing up; Holguns and Scruguns for drilling lead holes, countersinking and screw driving; "Shortys" for wiring and control installations; Electric Sanders for smoothing the sleek hulls at top speed!

***For Advice** on any tooling problem, and as a dependable, convenient source of supply, phone your nearby Black & Decker Distributor. Or write to: The Black & Decker Mfg. Co., 716 Pennsylvania Ave., Towson, Maryland.*

LEADING DISTRIBUTORS EVERYWHERE SELL

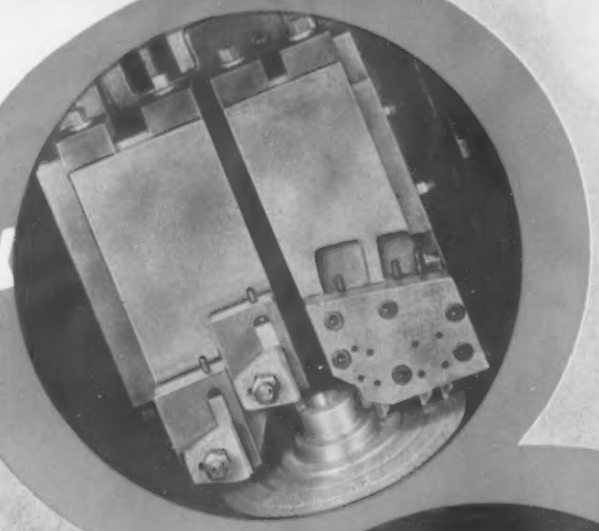
Black & Decker

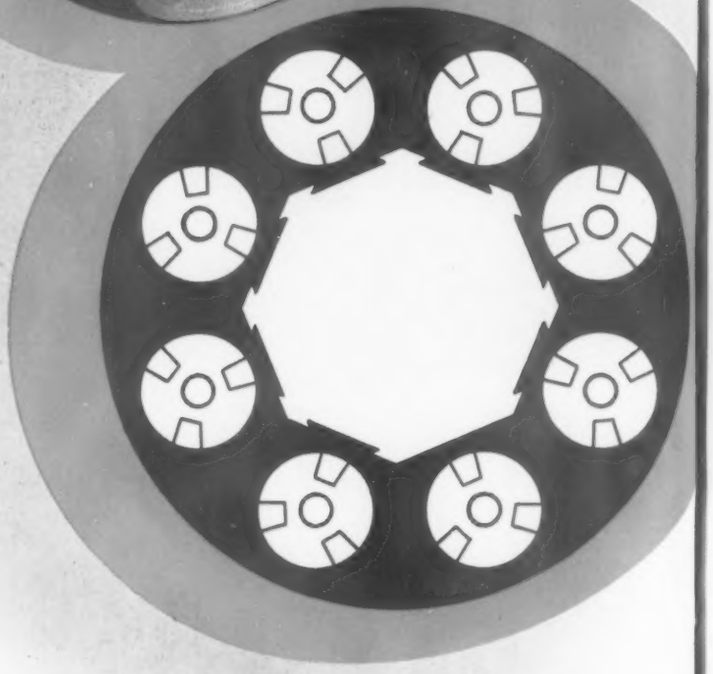
PORTABLE ELECTRIC TOOLS

BULLARD
ULT-AU-MATIC
THE
JOBS
GO TO
MULTI-AUTOMATICS

SPEED...

MULTIPLIED BY





Eight jobs in operation at once—loading, unloading and seven complex processes—a finished piece at every index! Each of the eight spindles with independent speeds and feeds—easily operated by one man! One man only—who loads and unloads. The rest is automatic on a Mult-Au-Matic!

Fast, accurate, versatile, in war and peace—Mult-Au-Matics give owners cost and time advantages unknown in other methods and with other machine tools.

Capacities, construction details, complete data furnished on request.

THE BULLARD COMPANY

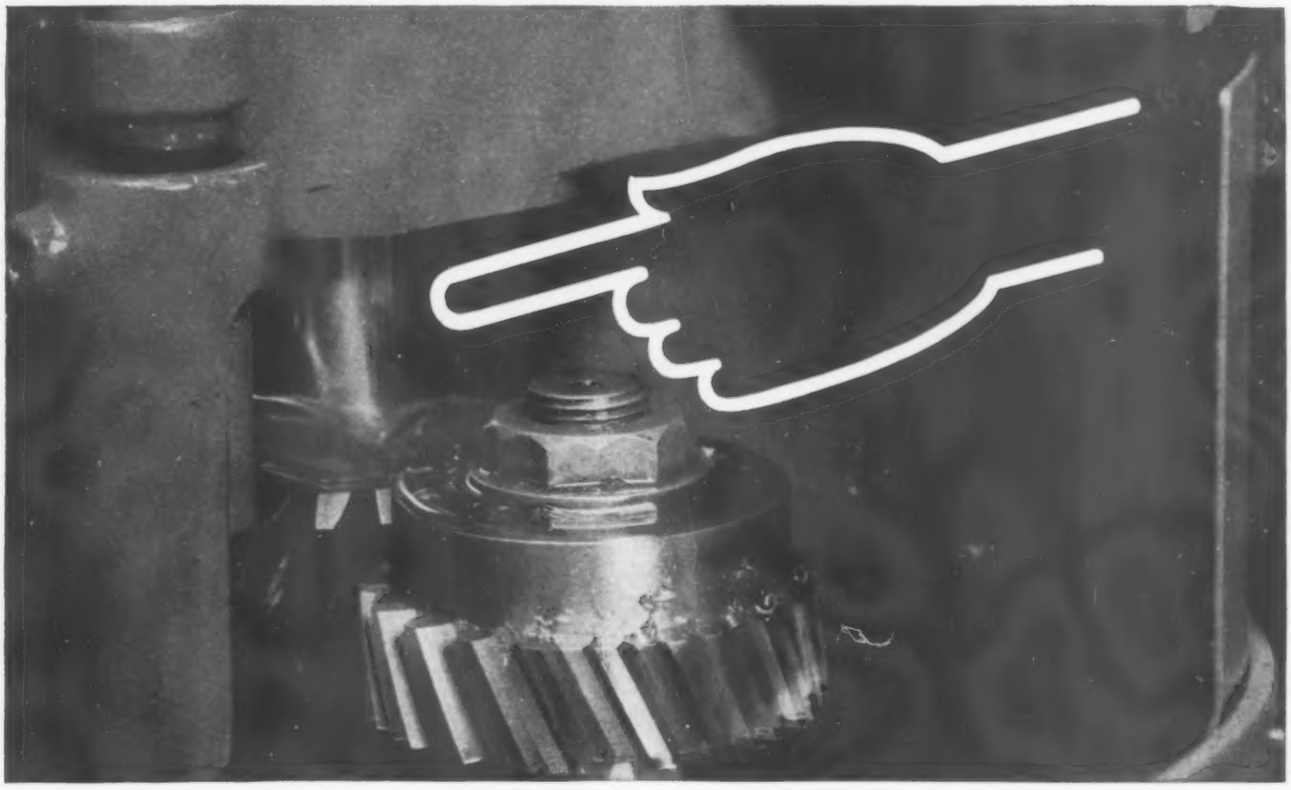
BRIDGEPORT
CONNECTICUT

HERE'S WHAT A MULT-AU-MATIC CAN DO

1 8 Stations
2 Independent Speeds and Feeds at each Station
3 Vertical Spindles (Quick Chucking)
4 Easy Tooling
5 Automatic Operation
6 Minimum Floor Space
7 Continuous Flow Lubrication

BULLARD MULT-AU-MATIC

Fast, Accurate, Versatile . . . . in War and Peace



EXCUSE US FOR POINTING

— but here's one bottleneck we know how to handle!

A cutting oil problem, especially these days, may develop into a nasty bottleneck. That means production slowed up, schedules delayed, and machinery idle. All in all, an extremely unpleasant experience for any wartime manufacturer.

We licked that problem long ago, not only in the laboratory, but under the severest conditions of day-to-day shop operation. That's why Cities Service can help you lick that problem with service-proved cutting oils engineered for your job by experienced lubrication technicians.

Why not get the benefit of our experience? We'll be glad to have a Cities Service lubrication engineer consult with you on the problems of your particular job. This service is yours for the asking. Just phone or write our office nearest you, today!

An informative booklet, "Metal Cutting Lubrication," is available to the personnel of cutting oil users. Simply fill out and mail the coupon below.

OIL IS AMMUNITION—USE IT WISELY!

CITIES SERVICE OILS
ONCE-ALWAYS

Write to —
CITIES SERVICE OIL COMPANY
Room 1326, Sixty Wall Tower, N. Y.
or any of the following offices:
CHICAGO · CLEVELAND · ST. PAUL
KANSAS CITY · BOSTON · TORONTO
or to
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FREE! Just Clip and Mail

Please send me booklet on "Metal Cutting Lubrication." A.M.

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Firm Name_____

Address_____

City_____ State_____

A LUBRICANT FOR EVERY INDUSTRIAL NEED

Thousands of Machine Gun Parts

HEAT TREATED IN THIS BATTERY OF MODERN SC *CHAR-MO FURNACES

● SC Standard Furnaces utilizing Char-Mo atmospheres are adding to the strength and durability of vital parts for machine guns in this war materials plant. These small machine gun parts are of high carbon and nickel alloy steels. They are charged on small trays heated to and held at proper heat treating temperatures, for the required period of time. Following the heat treatment, the trays are removed and the parts are oil-quenched in tanks beside each furnace. The process results in parts that have been clean-hardened without scale or decarburization.

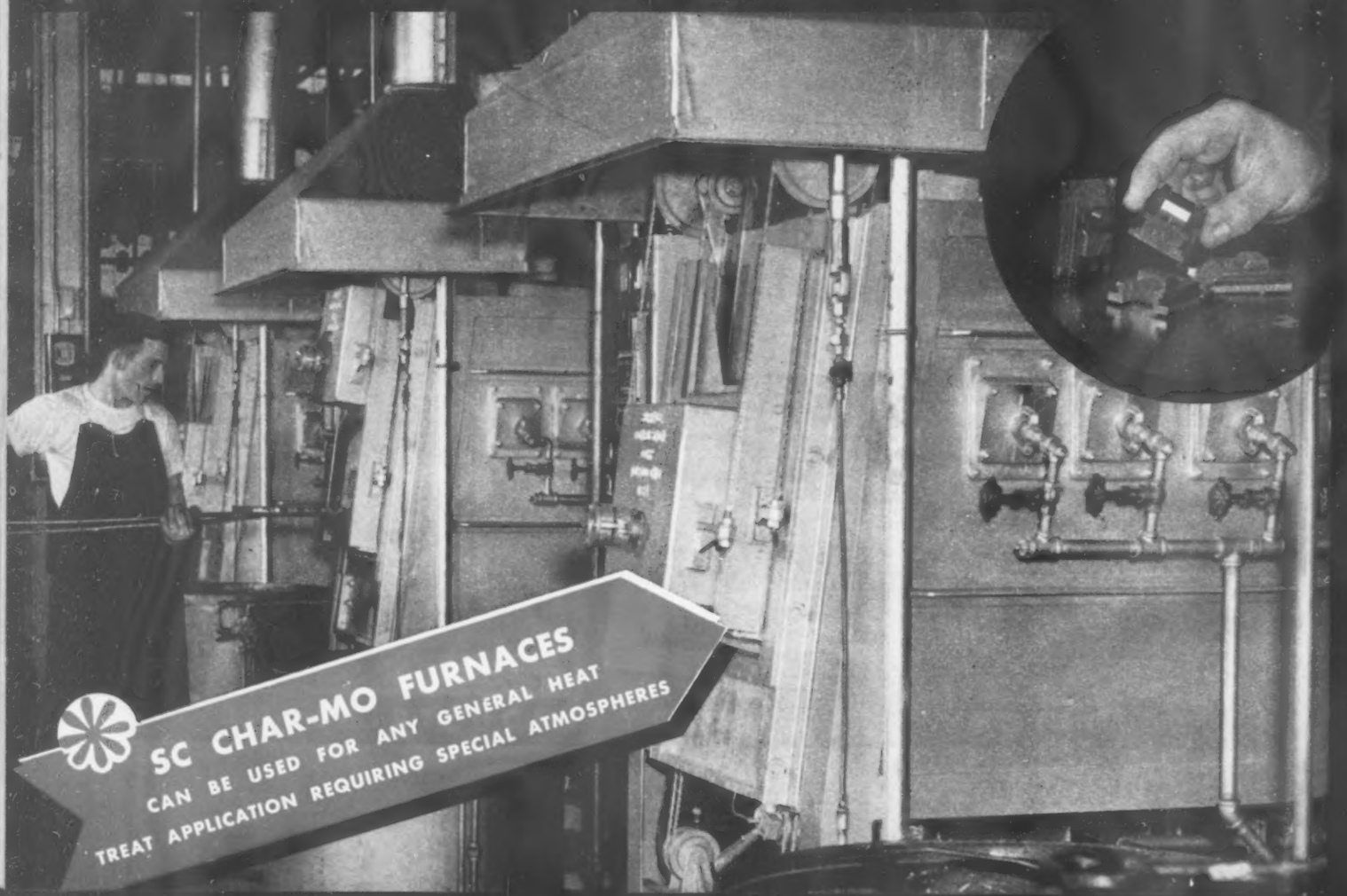
SC Char-Mo Furnaces are a popular choice of heat treaters due to the great flexibility of use for any heat treat application requiring special atmospheres, including hardening of high speed tool steels. SC Bulletin CM-41 gives complete sizes, specifications and operating data. Write for it.

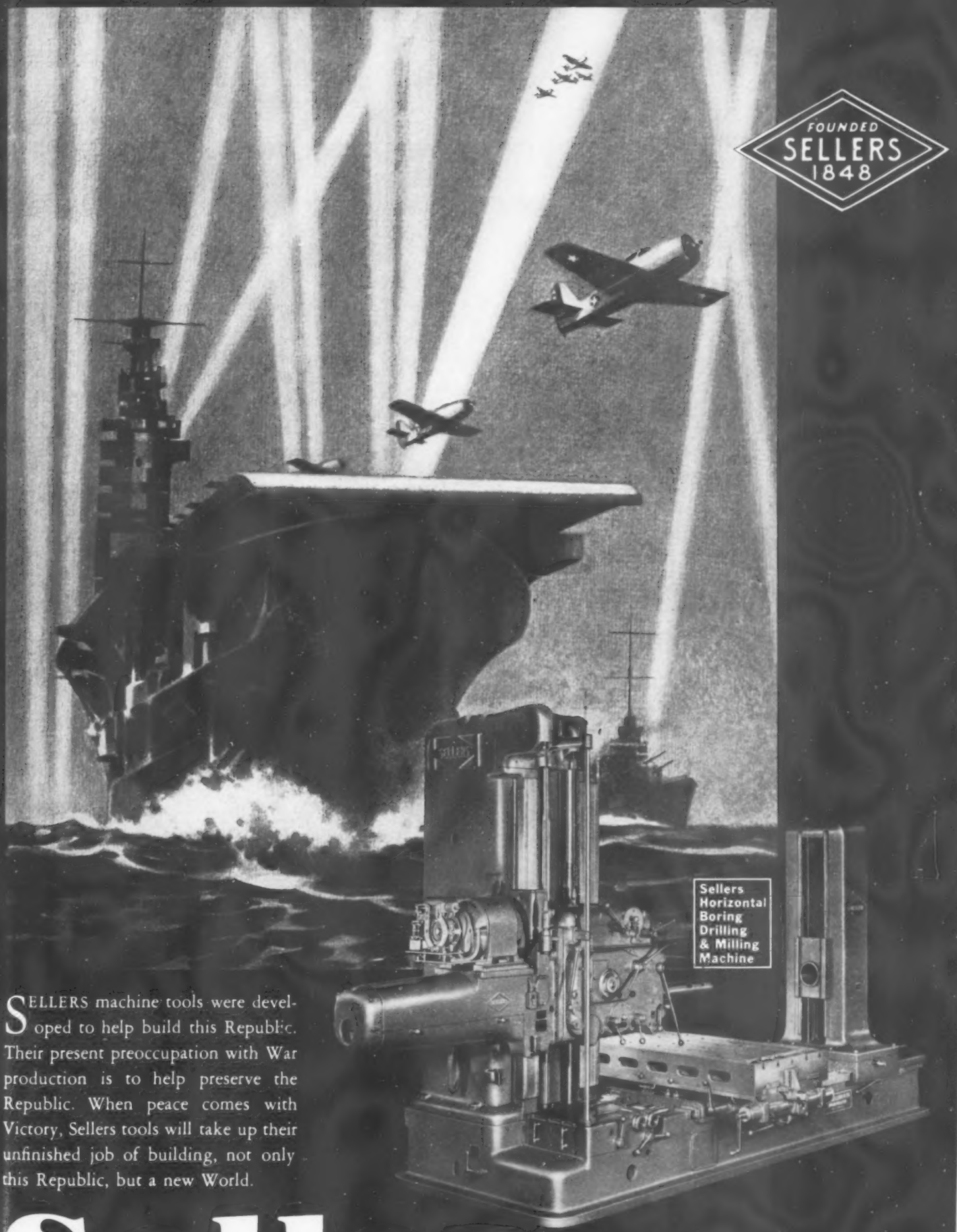
SURFACE COMBUSTION • TOLEDO, OHIO

"SECURITY FOR AMERICA"

SURFACE COMBUSTION

MANUFACTURERS OF INDUSTRIAL FURNACES · JANITROL GAS-FIRED SPACE HEATING EQUIPMENT · AND KATHABAR AIR CONDITIONING SYSTEMS





SELLERS machine tools were developed to help build this Republic. Their present preoccupation with War production is to help preserve the Republic. When peace comes with Victory, Sellers tools will take up their unfinished job of building, not only this Republic, but a new World.

Sellers

WILLIAM SELLERS & CO., Inc.
Philadelphia Penna., U. S. A.

parts remain

bright

AS A NEW PENNY

thanks to Tide Water Cutting Oil

No more time out between runs for cleaning machines and changing oil when production shifts from steel to brass to aluminum – not since Tide Water Cutting Oil went to work in this plant. No more squawks from the plating department about tarnished parts. Over five years performance on precision machining work in this plant has shown that Tide Water Cutting Oil keeps production at peak and machined parts "bright as a new penny."

This valuable aid to increased production is helping hundreds of busy plants achieve longer tool life, and fewer work interruptions. On a drawing operation with soft aluminum sheets, scrap loss dropped from 50% to 3% thanks to Tide Water Cutting Oil.

If lubrication or cutting problems are affecting your production schedules a Tide Water engineer can help you. He will recommend the Tide Water lubricant to fit your particular needs. For full information write today to Tide Water Associated Oil Company, 17 Battery Place, New York.

DRUMS! DRUMS! DRUMS! DRUMS!
War needs make it extremely important that all empty drums be returned immediately.

TIDE WATER ASSOCIATED OIL COMPANY
EASTERN DIVISION: 17 BATTERY PLACE, NEW YORK
Regional Offices: Boston, Philadelphia, Pittsburgh, Charlotte, N.C.

MAKERS OF THE FAMOUS VEEDOL MOTOR OIL

Announcing

STANDARD

Rocker-Arm

Welders

Capacities—20, 30, 40 and 50 KVA.
Throat Depth—4 Sizes—12 to 36 inches.
Operation—Foot, Air or Motor Driven.
Construction—Completely Streamlined. Heavy duty. Easy to service.

Flexibility—Lower arm adjustable 8 inches vertically. Also in-and-out and rotary arm adjustment for electrode alignment and use of angle electrodes.

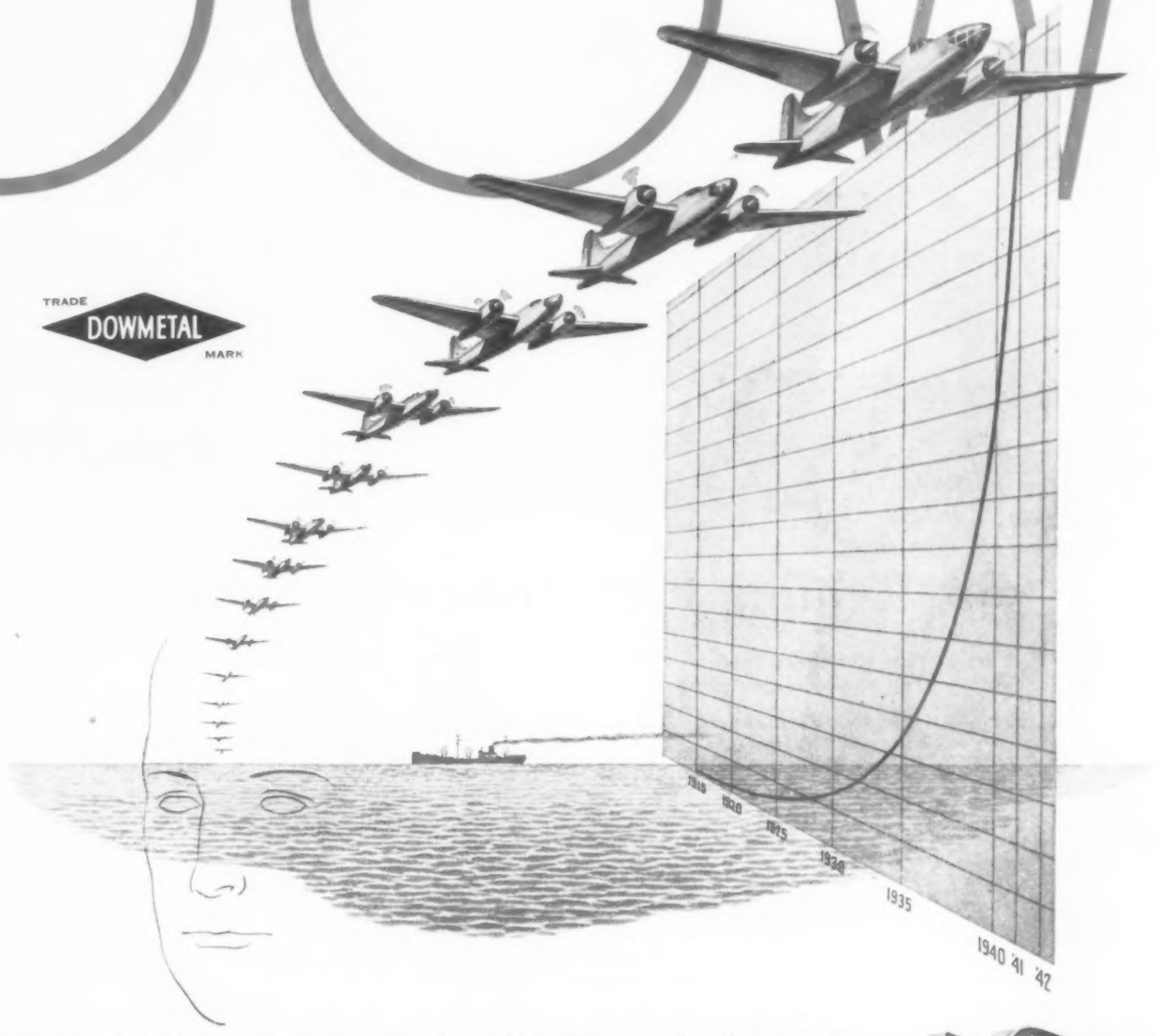
Ask for Bulletin No. 701 AM

PROGRESSIVE WELDER CO.

SEAM, PROJECTION & BUTT . . . *Electric Welding Equipment* . . . PORTABLE GUN & PEDESTAL

3050 E. OUTER DRIVE DETROIT, U.S.A.

DOW



CONSTRUCTION of airplanes for victory calls for a boundless supply of magnesium. The production curve of this remarkable weight-saving metal rises ever higher as Dow extracts millions of pounds from the waters of the sea. The eye of the designer is on the future when these vast quantities of magnesium will release more horsepower for peaceful purposes and lighten our daily tasks in innumerable ways.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

MAGNESIUM

The Lightest Structural Metal . . . One-third Lighter Than Any Other in Common Use

MALLORY STANDARDIZED WELDING ELECTRODES

SPEEDIER PRODUCTION

BETTER WELDING

LESS DOWN TIME

LOWER COST

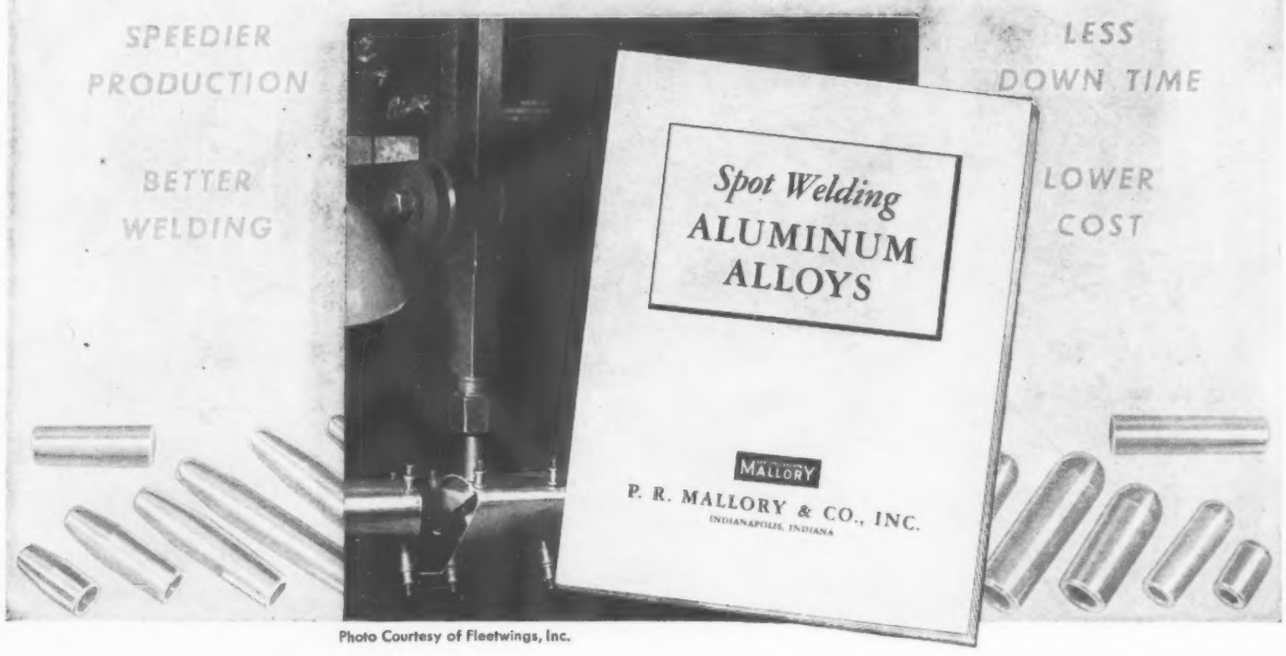


Photo Courtesy of Fleetwings, Inc.

For Welding Engineers with a Future!

This 12-page booklet, "Spot Welding Aluminum Alloys", has a place at the elbow of every design or production engineer who has an eye to the future.

It is a carefully diagrammed treatise, offering in compact form the essential data on:

- Spot welding characteristics of aluminum and its alloys . . . with comparative values for other metals. Tabular data and discussion.
- Spot welding equipment for aluminum alloys. Diagrams and descriptive data on
  - **a. Welding Machines**
    1. Magnetic Storage Welders
    2. Condenser Storage Welders
    3. Rectified Three Phase Welder
    4. Standard A. C. Welders
  - **b. Electrodes**
    1. Materials
    2. Design
    3. Electrode Holders and Cooling
- Design of spot welded joints. Diagrams, tabular data, graphs and discussion.
- Aluminum welding technique. Graphs, tables and discussion relative to the four types of welding machines listed above.

Take a minute now to write for your free copy of "Spot Welding Aluminum Alloys." It belongs on your bookshelf, along with that complete reference, the 79-page Mallory Resistance Welding Data Book.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA • *Cable Address*—PELMALLO

RESISTANCE WELDING P.R. MALLORY & CO. Inc. **MALLORY** **STANDARDIZED ELECTRODES**

Home to Roost

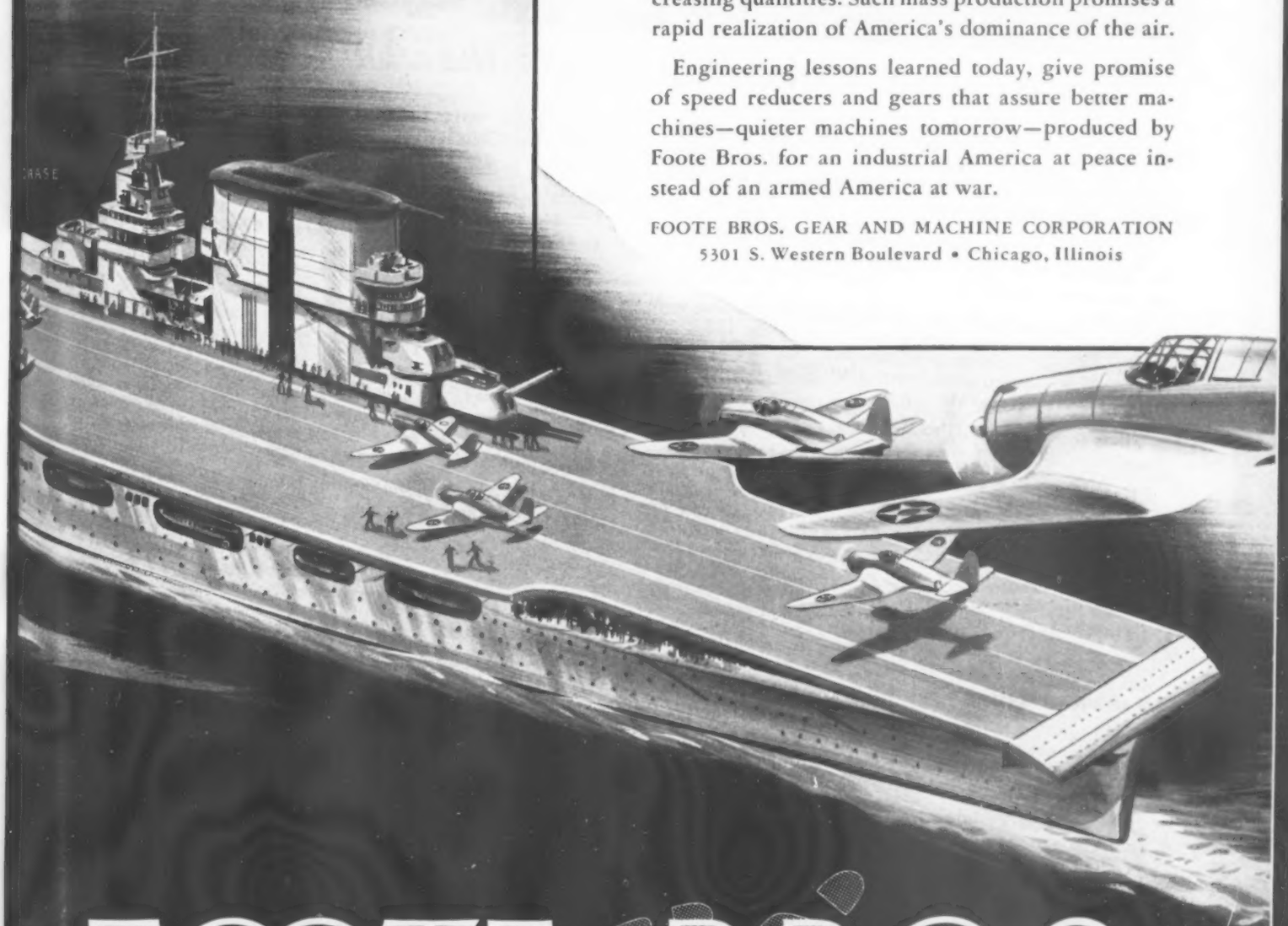
HOME TO ROOST, these eagles of the fleet return from their exploits of daring. In a voice a billion horsepower strong, the story they tell of American industrial might is ringing in the ears of Axis powers from Honshu to Hamburg.

That such an intricate mechanism as the engines that power these war eagles can be mass-produced is a tribute to the mechanical genius of American industry.

To transmit the thousands of horsepower that modern aircraft engines develop, gears must be finished to an accuracy that only a few months ago was considered a laboratory ideal. Yet today, thanks to new manufacturing techniques, these gears are rolling off production lines at Foote Bros. plant in ever increasing quantities. Such mass production promises a rapid realization of America's dominance of the air.

Engineering lessons learned today, give promise of speed reducers and gears that assure better machines—quieter machines tomorrow—produced by Foote Bros. for an industrial America at peace instead of an armed America at war.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois



FOOTE BROS.

SPEED REDUCERS • GEARS • SPECIAL ASSEMBLIES

"Praise the Lord and *Pass the Ammunition*"

THIS Pearl Harborism,* uttered by a fervent Navy chaplain, will live in our school books long after today's headlines and swaying battle lines have passed into history.

It exactly expresses the unique combination of the spiritual and the practical which is inherent in our national character.

. . And America IS *passing the ammunition.* Starting with an atrophied military explosives industry in 1939, the Production for Defense program had raised the rate of "passing the ammunition" by 1400% at the time the chaplain spoke.

▶ Since then, according to an official statement of Donald Nelson:

"Explosives and ammunition are being made at many times the rate of last year as newly constructed plants come into operation. TNT is being made at a rate five times that before Pearl Harbor. Smokeless powder is being produced at a rate almost twice that before Pearl Harbor. One new plant is making more TNT today than the entire explosives industry produced in peacetime and there are several of this type of plant."

Incendiary bombs are vital ammunition in the kind of war we are in. America's chemical industry is far ahead of schedule in passing along that potent ammunition.

Magnesium is part ammunition, part construction material. You know it's now being taken from sea-water, but do you know that we are making at least 100 times as much magnesium now as we did in 1938?

100-octane gasoline isn't ammunition, but it's handy to have around in a war, because bombers using this product of American chemistry can carry an extra ton of what it takes to win.

Synthetic rubber is another necessity in passing the ammunition. The Chemical Industry faces the staggering job of producing more rubber than all the rubber trees in the world were able to pour into the American market prior to the war . . . 875,000 tons per year by 1944 is the goal. Those of us who have seen tank-factories and shipyards grow faster than the corn-crops they replaced believe the Chemical Engineers of America will do the job.

What is the secret of these amazing modern counterparts of the frontiersman's ability to turn from peace to war?

▶ One of the important answers is Chemical Engineering. We just naturally have more men and more machines that know how to make a molecule behave than any two nations on earth.

Starting after World War I, our chemical engineers used the experience gained in guncotton factories to develop the vast peacetime Chemical Industry which gave you rayon, lacquer, transparent wrapping paper, plastic telephones, knockless gasoline, shatterproof glass, synthetic vitamins, laboratory-fathered medicines, plastic tips for your shoe laces, nylon hosiery, and thousands of other comforts to help you live a peacetime Life of Riley.

This vast activity of making life more livable for peaceful Americans had created an enormous pool of management and production men in our chemical industries.

When war came, these men answered their country's call, by rearranging their peaceful atoms into bellicose molecules that would explode, fly, float, shoot or stop a bullet.

Today, fertilizer, salt, whiskey, rayon, even pine stumps are being turned into products of unrecognizable ferocity.

▶ When the war is over, it will be the imagination of the Men of Chemistry that will set our great new war-chemical plants upon a new era of peacetime fruitfulness. Even while the chemical engineer is breaking production records for war, he is planning for a peacetime production that will revert these molecules toward serving our daily lives. Chemical Warfare will become Chemical Welfare, through Imagination.

* * *

In recognition of the miracle of war production—accomplished through the cooperation of American management and labor with the W.P.B. . . . this 7th in a series of newspaper advertisements is published by the McGraw-Hill Network of Industrial Communication.

*Also title of Gene Lockhart's famous fighting song of World War II

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42ND STREET . . NEW YORK

This advertisement appears in a group of newspapers on Wednesday, September 9, 1942

. . . . . and pass the INFORMATION

WHEN an American gunner calls for ammunition, whether he wears a cross—like the chaplain in our newspaper advertisement—or a tattooed mermaid, he sets in motion the mightiest war-machine on earth . . . American Industry.

Knitting together all the industries of America, making it possible for them to turn *quickly* from peace to war, is the Industrial Press.

When the gunner yells for AMMUNITION, industry yells for INFORMATION. It is the job of the industrial magazines to supply it.

"What do we do when we can't get stainless steel for a Toluol recovery plant?"

"Which is the best section of the country for locating our new plant, considering power supply, bombing range and transportation?"

"How can we step-up the alcohol output of our stills, without using scarce metals?"

"What's the best method of training 18,000 green hands to get quick operating efficiency?"

These are typical of the questions that flow over the desks of our editors day after day.

They keep nearly 900 McGraw-Hill editors and engineer-correspondents busy, making field calls, finding the best answer to each problem and reporting the results to management and production men.

Industrial advertisers supplement this work by showing how their products meet specific needs.

This constant interchange of information is part of the strength and adaptability of American Industry.

It is so important that executives are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, write to The Reading Counselor, McGraw-Hill Publishing Company, Inc.

* * *

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,000,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL PUBLICATIONS

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Aviation
Bus Transportation
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Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
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E. & M. J. Metal and Mineral Markets
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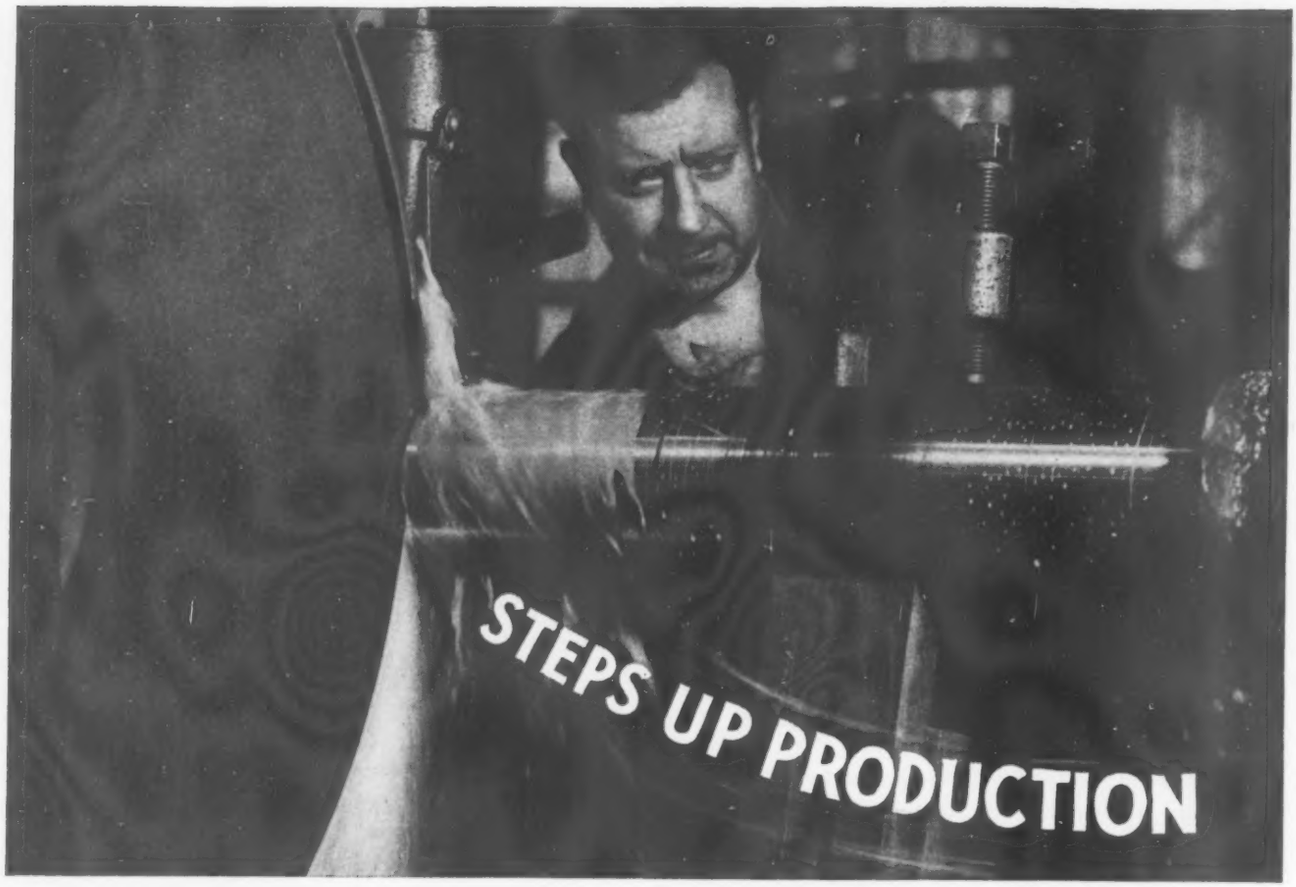


SAFCO METAL WORKING LUBRICANTS
for peak production

Production up 20% . . . up 30% and more!* Many reports like these are coming in from important war production plants who have tested Swan-Finch 'SAFCO' coolants and lubricants in metal working operations.

As requirements become *more* exacting . . . closer tolerances, smoother finishes, greater operating speeds, 'SAFCO' lubricants become *more* in demand than ever.

The rapidly increasing use of 'SAFCO' lubricants when the job gets tough, is due to our background of cumulative experience . . . over 40 years of continuous research in formulating and developing metal working lubricants.

Every day our field men are *proving* thru tests and recommendations that 'SAFCO' can save time . . . *can increase production.*

It will pay you real dividends to get better acquainted with the Swan-Finch field representative who covers your district. Capable and able, they are constantly devising *new* ways and means for stepping up production.

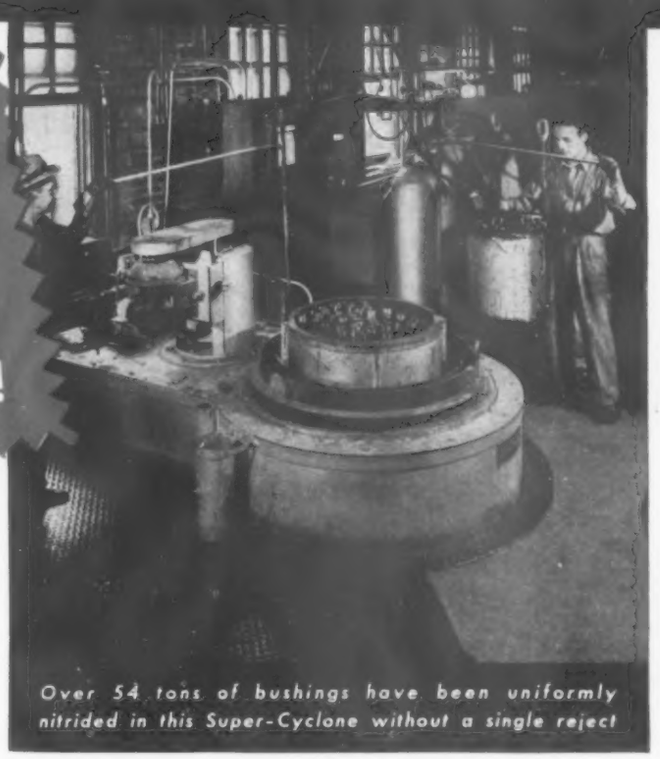
For instance meet Howard Rose. He is one of our highly trained and experienced fieldmen ASK US TO HAVE HIM CALL—NO OBLIGATION

**Reports in our files on metal working operations sent upon request*

SWAN-FINCH OIL CORPORATION

Offices		Plants	
New York City—Executive Offices	R.C.A. Building, West	Newark, N. J.	120 Lister Avenue
Chicago, Ill.	201 North Wells Street	Chicago, Ill.	5849 West 66th Street (Clearing, Ill.)
Detroit, Mich.	2596 Hart Avenue	Detroit, Mich.	2596 Hart Avenue

OVER 54 TONS OF BUSHINGS NITRIDED IN A LINDBERG SUPER-CYCLONE without a single reject!



Over 54 tons of bushings have been uniformly nitrided in this Super-Cyclone without a single reject

A SUPER-CYCLONE is nitriding 3450 pound loads of bushings with uniform case and hardness in a large manufacturing plant in the Middle West. The bushings are 3¼" to 4½" in length and 1¾" to 3" inside diameter, with a maximum section of ¼".

A load of 1350 of the bushings are placed in a basket and charged into the retort of the Super-Cyclone where they are uniformly heated in ammonia gas for 72 hours at approximately 980°F. The parts have a .032" to .034" case depth and are never more than .002" out of round.

These results have been consistent since the Super-Cyclone's installation and to date over 50,000 of these bushings, more than 54 tons, have been nitrided *without a single reject!*

BUT WHY USE THE SUPER-CYCLONE?

Why not a low-temperature standard type nitriding furnace? The answer is that the same uniform job of nitriding could be handled in the Standard Cyclone Nitriding Furnace which has a top temperature of 1250°F., but this manufacturer, in obtaining the Super-Cyclone, looked further ahead than the job in hand.

In connection with the nitriding work, he can "cure" or denitride the retort by taking advantage of the high temperature range of the Super-Cyclone and, with the retort in the furnace, run the heat up to 1600°F.

A companion Super-Cyclone in the same plant is now employed for production hardening. After the nitriding job has been discontinued, he will have two 100% forced convection heated furnaces with temperatures from 250°F. to 1750°F. for hardening, annealing, normalizing, tempering, or any other heat treating operation which falls within that range.

Uniformly nitrided, this typical load of bushings has just been removed from the Super-Cyclone.

MANY ADVANTAGES

The Super-Cyclone, with its 100% forced convection heating principle and its wide temperature range, offers a variety of uses. In addition, it increases production through rapid, uniform heating of heavy loads, eliminates distortion due to uneven heating, reduces handling of material by employing a fixture to carry loads through all heating and quenching operations, and requires less floor space than conventional equipment to bring all these advantages.

Write for Bulletin 130. It gives more complete information on material handling, furnace operation, economy of floor space, sizes available and ways to figure Super-Cyclone production possibilities in your own shop.

MOVIE

Write now to reserve a date for Fall and Winter showings of the full length sound and color Heat Treating Hints movie. Loaned without charge, this film shows actual heat treating operations going on with the editors of Heat Treating Hints at their furnaces, quench tanks and straightening presses. Each operation is thoroughly explained to the satisfaction of the greenest trainee. The film is purely educational and contains no advertising.

For your coming plant or chapter activities, may we suggest that you send today for the pamphlet giving complete instructions on how to arrange for the Heat Treating Hints movie.

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HYDRYZING FOR SCALE-FREE AND DECARB-FREE HARDENING

Wanted urgently:

STEEL SCRAP

Shortage of steel scrap is threatening the war-production program.

If ships, planes, tanks and guns are to be produced in the volume needed to win the war, the country's steel-making facilities must operate at full capacity. But the plain truth is that the steel scrap to support continued capacity operations is not available, and not in sight.

United Effort Will Do the Job

Thanks to the construction of new blast furnaces, the deficiency is being partly made up by using more pig iron in steel-making. But tremendous quantities of additional scrap must be found within the crucial next few months.

Actually, many thousands of tons of steel scrap are potentially available *if only they can be gathered in*. This scrap, needed so urgently in the war effort, is scattered through the industrial plants, mines and railways, the farms and the homes of the nation. The problem is to collect it and get it moving to the steel mills. Everyone must help. If everyone will, there will be scrap to meet the needs of the war-production program.

Make a checkup in your plant or warehouse, or any other property you own or manage, and in your home.

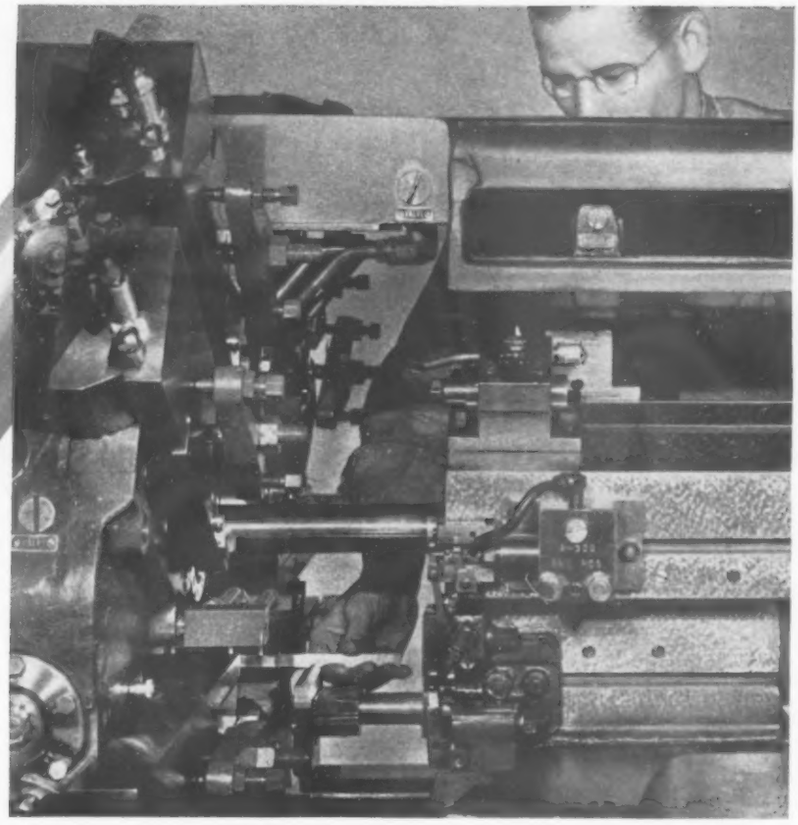
Have any odds and ends of steel or iron that may be lying around collected. If you have any obsolete or idle equipment, machinery, or parts—anything that's made of iron or steel and isn't really needed—junk it, and get the scrap moving toward the steel mills.

How to Put Your Scrap to Work

Some iron or steel now lying rusting and forgotten around your property may help to save the lives of Americans in the battle areas. Gather up every possible bit of iron and steel scrap. Sell it to a local junk dealer, or get in touch with your local scrap salvage committee. Put your scrap to work for your country. It's needed, now!

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL



TOOLING AREA of a Greenlee Six-Spindle Automatic Screw Machine. This type of machine is widely used in the production of 20- and 37-mm projectiles.

PROJECTILES *faster and at less cost*

IN projectile manufacture, prominent automatic screw machines are showing greatly increased output, higher surface finish and longer tool life . . . using *Texaco Transultex Cutting Oil BB.*

Texaco Cutting Oils carry away heat and lubricate the tool, preventing chip welding and assuring better surface finish. This means increased output per tool grind.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal-cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

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TEXACO REG. T.M.

TEXACO Cutting Oils
FOR THE METAL-WORKING INDUSTRY

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

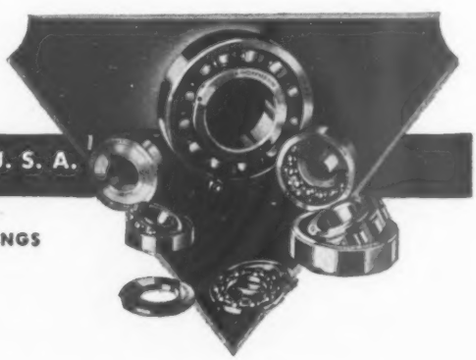
YOUR MACHINE EQUIPMENT

A treacherous, insidious saboteur lurks in every plant engaged in war production, alert to every opportunity to damage your machines and curtail your output. FRICTION is his name, and your only safeguard against him is the vigilant protection of F.B.I.—FREQUENT BEARING INSPECTION.

Keep all bearings clean and well lubricated. Exclude dust, dirt and moisture. Use only high-grade lubricants. Watch for the first signs of unusual heat or noise or looseness in the bearings. If possible, keep replacement bearings at hand, for a quick substitution if needed. America, in her vast war program, cannot afford to lose a single machine-hour of production. Guard against such losses by FREQUENT BEARING INSPECTION.

We will gladly cooperate with you in maintaining or increasing your production—by experienced counsel on the use and care of anti-friction bearings, and by supplying you, wherever possible, NORMA-HOFFMANN PRECISION BEARINGS for replacements.

Write for the Catalog. Let our engineers work with you.



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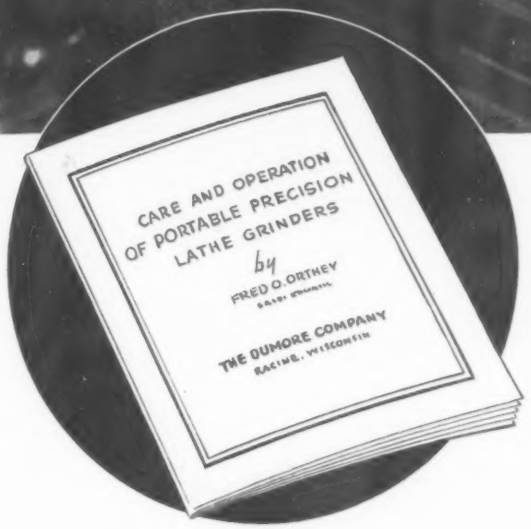
PRECISION BALL, ROLLER AND THRUST BEARINGS

1/44 the thickness of a postage stamp

YOU CAN GRIND THAT ACCURATELY WITH A DUMORE



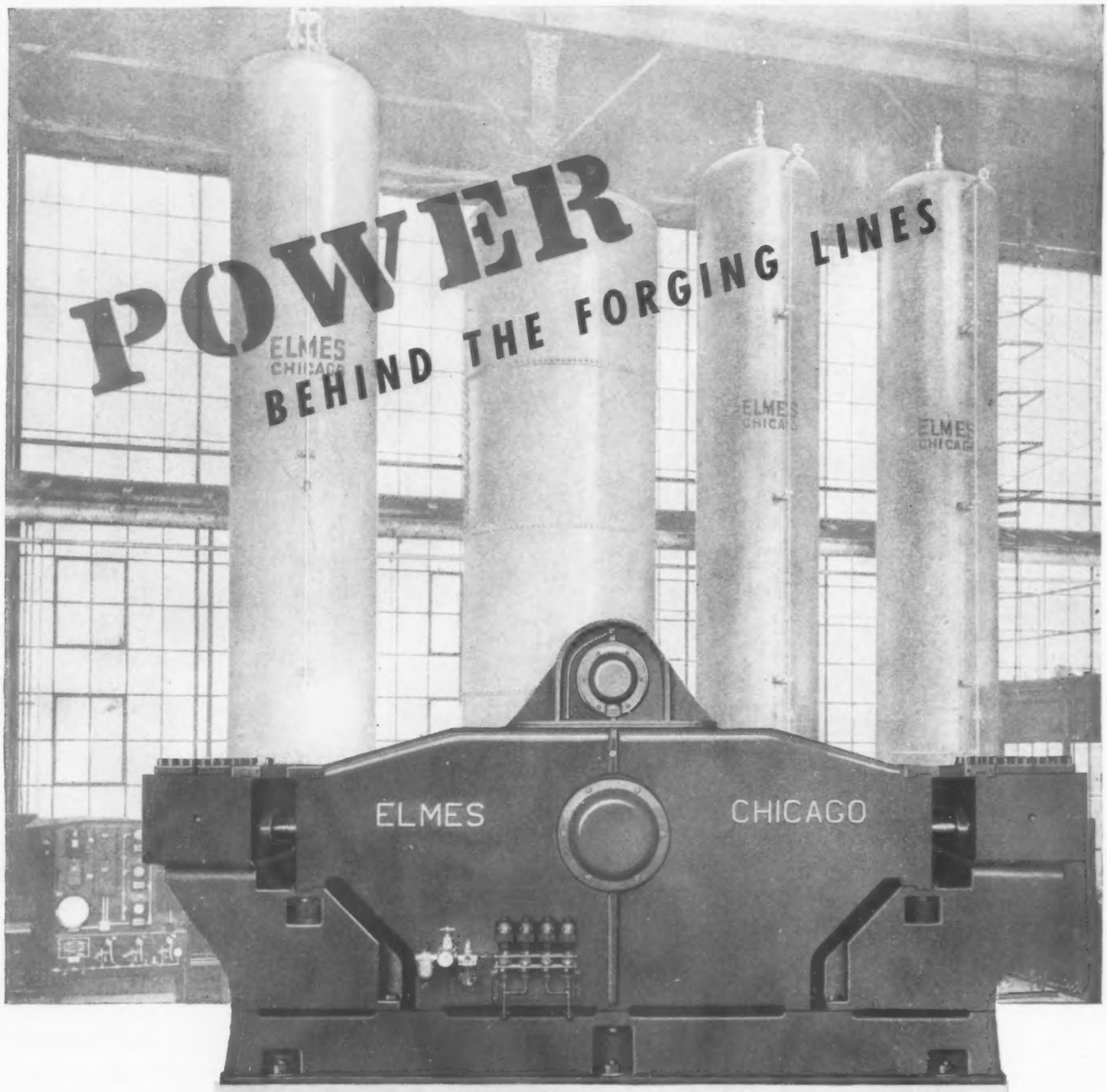
WRITE FOR THIS HELPFUL INSTRUCTION BOOK ON PRECISION GRINDING

Maintenance of tools is a vital wartime necessity. For this reason, the Dumore Company now offers this practical handbook FREE if requested on your company letterhead. Regularly priced at 25 cents.

This is a war of men and machines — the greatest race in production in the history of civilization. Never before has it been more important to make the most of your manpower and production facilities. Dumore Grinders are doing their part by speeding up war production in arsenals, shipyards and the metal-working industry, modernizing old machines, saving labor, and cutting costs. The No. 5 shown above, with a 3-bearing extension quill, handles a deep internal grinding job on a Heald lathe. Dumore Grinders can be mounted on lathes, shapers and milling machines for internal as well as external grinding. They can hog off rough cuts, yet finish to an accuracy of .0001". . . 1/44 the thickness of a postage stamp. The Dumore tradition of quality is based upon a quarter century of research in precision grinding and the highest standards in material and craftsmanship. Call on Dumore to help you in your war production problems. See your nearest distributor, or write today.

THE DUMORE COMPANY • **Racine, Wisconsin**

Dumore PRECISION Grinders



POWER! . . . Power in huge quantities . . . Power for greater production . . . Power stored under finger tip control.

Elmes equipment supplies such power. First, an Elmes modern, efficient roller bearing pump develops the power. Second, an Elmes air ballasted type hydraulic accumulator system stores the power. Third, the touch of a finger instantly sends the power to forging presses, forming presses, or other equipment.

Some of the significant advantages of Elmes air ballasted type hydraulic accumulators are:

(1) Uniform Pressure . . . line shocks eliminated—reducing maintenance on pipe joints, packing etc. (2) No ballast weights required. (3) No large moving parts to wear. (4) No pistons or piston packings to maintain. (5) Floor space conserved. (6) No heavy foundations required. (7) Finger-tip control for variable pressure, if desired. (8) Simple, safe, foolproof. (9) The ideal means for storing liquid under pressure. Design based on years of experience by pioneers in the field.

Elmes engineers will cheerfully study your hydraulic power problems and make suggestions. Why not write them today?

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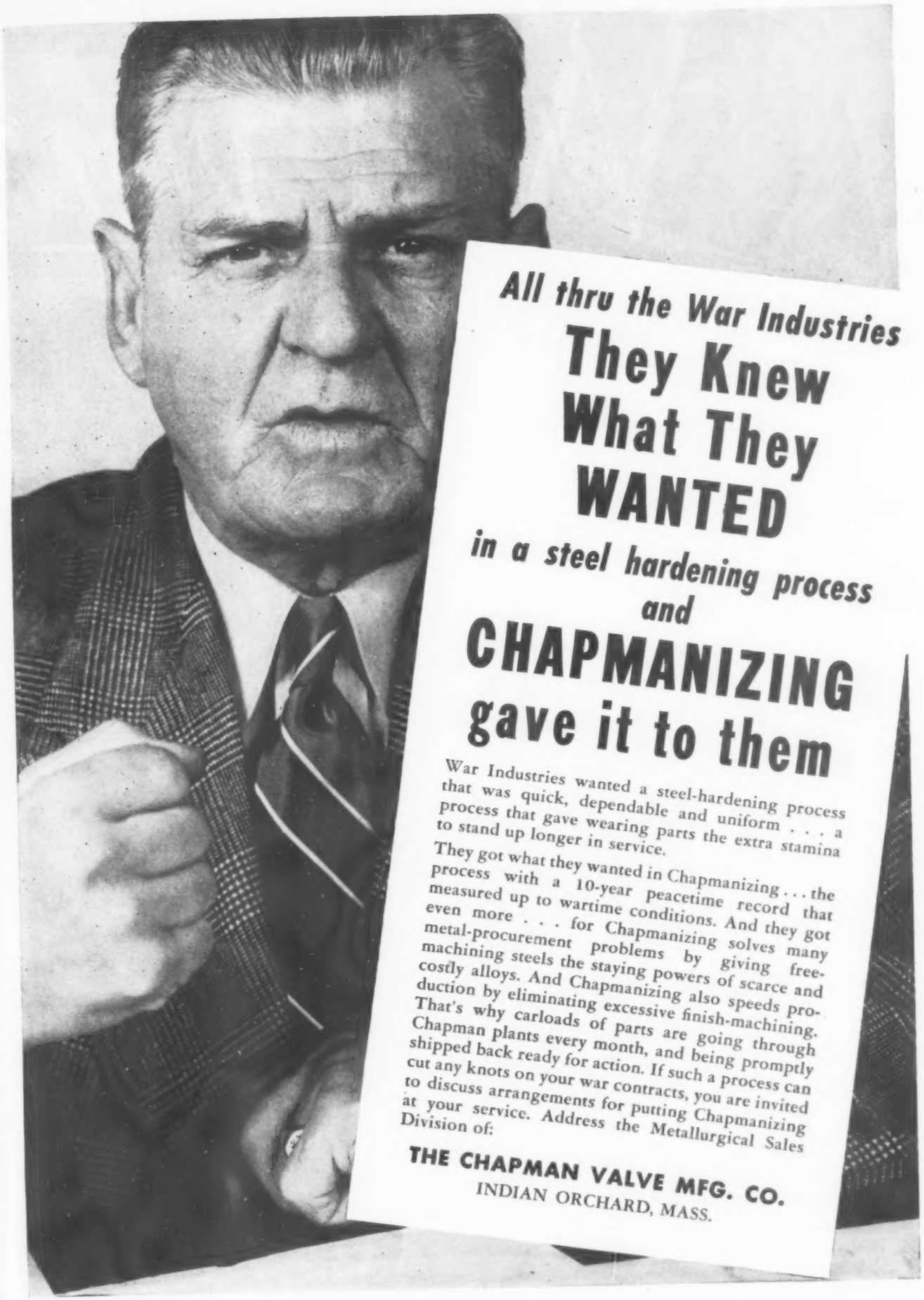


All thru the War Industries

They Knew What They WANTED

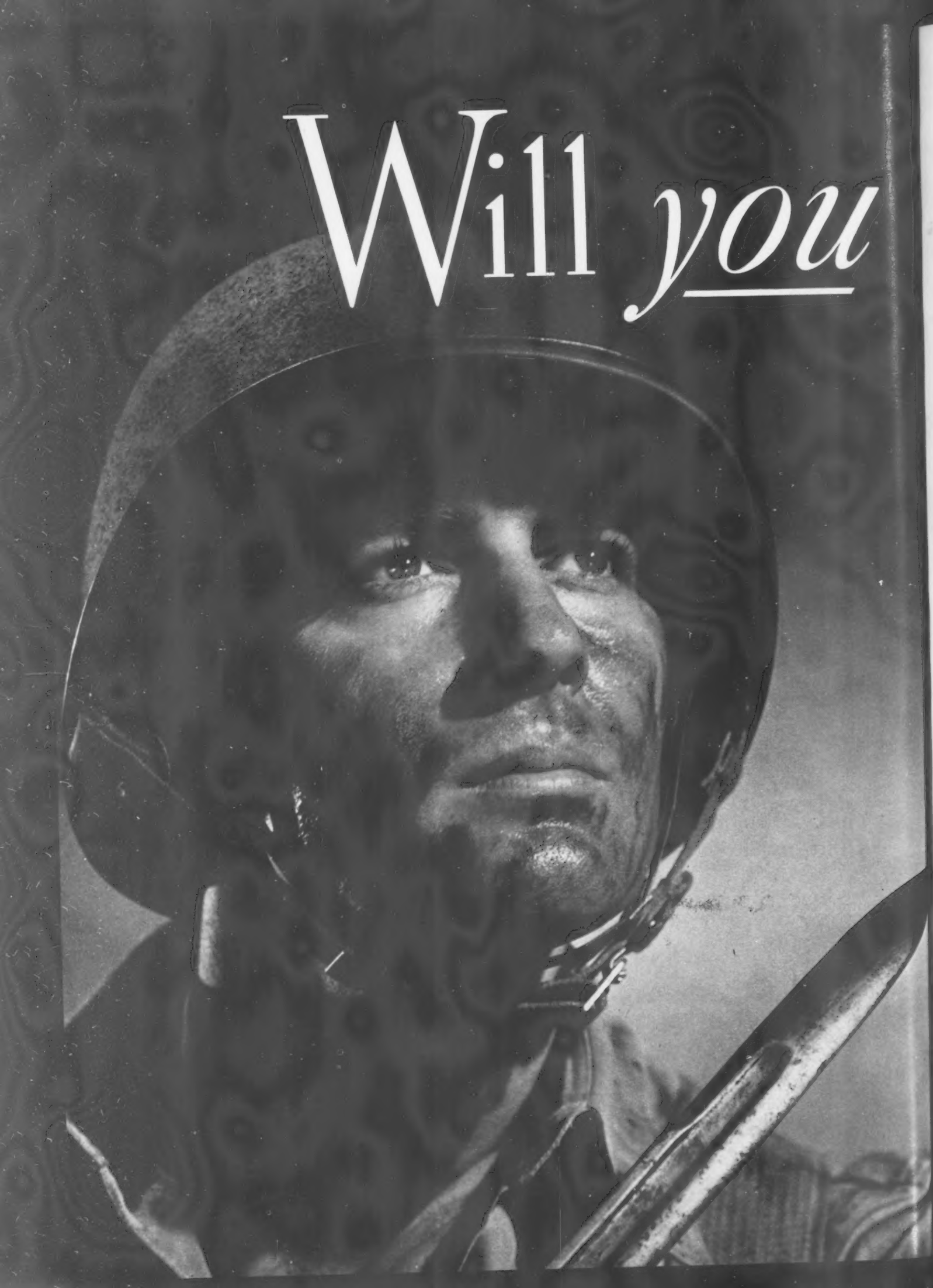
in a steel hardening process and

CHAPMANIZING gave it to them

War Industries wanted a steel-hardening process that was quick, dependable and uniform . . . a process that gave wearing parts the extra stamina to stand up longer in service.

They got what they wanted in Chapmanizing . . . the process with a 10-year peacetime record that measured up to wartime conditions. And they got even more . . . for Chapmanizing solves many metal-procurement problems by giving free-machining steels the staying powers of scarce and costly alloys. And Chapmanizing also speeds production by eliminating excessive finish-machining. That's why carloads of parts are going through Chapman plants every month, and being promptly shipped back ready for action. If such a process can cut any knots on your war contracts, you are invited to discuss arrangements for putting Chapmanizing at your service. Address the Metallurgical Sales Division of:

THE CHAPMAN VALVE MFG. CO.
INDIAN ORCHARD, MASS.


Will you

let him die?

-because of the little things you don't do?

He's a real fellow—a healthy, husky chap—maybe your own son, brother, nephew, friend. Yesterday he had a promising future at his finger-tips. Today he's out there giving everything he has to protect it—and your future, too.

BUT—unless he gets as much or more, as good or better fighting tools than the enemy—he and his buddies may die. Are YOU going to stand by and let that happen when you can help him? Sure, you're doing big things in your plant—but how about the seemingly *little things* that may decide whether or not you will be able to do big things tomorrow? How about your alloy scrap steel, for instance? Are you segregating it as you should?

WHAT ABOUT ALLOY STEEL SCRAP SEGREGATION? HERE'S WHY IT IS SO VITAL!

Fighting tools are made of steel. More armament demands more steel—including huge tonnages of *ALLOY STEEL.* And the steel industry is striving mightily to furnish it.

BUT, in spite of rapid expansion of facilities, and the 24-hour-a-day sweating toil of thousands of skilled men of steel, *SUFFICIENT ALLOY STEEL CANNOT BE PRODUCED UNLESS THE INDUSTRY GETS MORE NICKEL, CHROMIUM AND OTHER CRITICAL ALLOYS.* For these are the elements needed to make steel tough, strong and hard enough to stand up under the gruelling service in the mechanized armament which wins wars today.

If you are working alloy steel, your scrap piles and boxes contain valuable amounts of nickel, chromium, molybdenum and other vital alloys which can be used in making new alloy steel. BUT to use them immediately and efficiently, *the chips, turnings, shearings and other scrap from each grade of steel must be kept separate—segregated at the machine and each lot correctly labeled with the grade number (SAE, AISI, NE or other) of the steel.*

If you do not segregate your alloy steel scrap, it will mean just this: (1) Alloys in the scrap may be lost or wasted because the alloy content is unknown when the scrap is charged into the furnace; or (2) the heat of steel may be ruined; or (3) the scrap must be melted down, poured into ingots and analyzed. This ties up skilled furnace crews and furnaces which should be turning out finished steel. Chemists and metallurgists must take time to analyze the ingots to determine what and how much alloys they contain. Then the scrap ingots must be charged into the furnace again when the desired analysis is being produced. *Such waste aids only the enemy.*

Our fighting men need good fighting tools—QUICKLY. Fabricators need alloy steels to make them. The steel industry needs alloy scrap of *KNOWN ANALYSIS* to make more alloy steel. *Will you help us to help our armed forces by issuing an order NOW to your plant to segregate alloy steel scrap and return it PROMPTLY?*

REPUBLIC STEEL — PRODUCTION FOR VICTORY

This Advertisement Sponsored by

REPUBLIC STEEL CORPORATION

Alloy Steel Division Sales Offices: Massillon, Ohio • General Offices: Cleveland, Ohio

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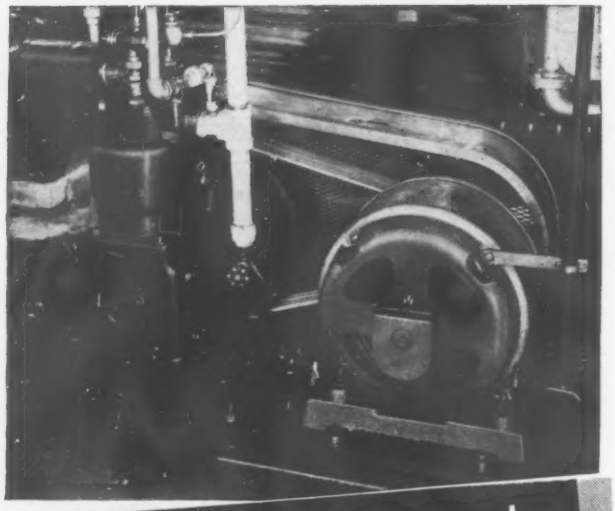
In Cooperation with the U. S. Government's Salvage Campaign

Poster size reprints of this advertisement are available for your bulletin boards. Write for them.



Cycle Company Installs Another CURTIS COMPRESSOR Because It Compared Maintenance and Operation Costs!

The Shelby Cycle Company, Shelby, Ohio, uses air to operate pneumatic arbor presses, air hoists, paint sprayers and press die knockouts.

Their first Curtis compressor was purchased in 1933; because of its satisfactory operation, compactness of design and low operating and maintenance cost, *as compared to a compressor of another type*, a second Curtis unit was added when they needed more air.

This is but another example of the dependability and efficiency of Curtis Model "C" Air Compressors — proven by the operating records of thousands of installations throughout the world.

Curtis performance is the result of such advanced engineering and design features as Timken Roller Bearings, Carbon-free Disc Valves, Centro-Ring Oiling, and Precision Workmanship in every detail. All parts are extremely accessible — available in capacities up to 360 cfm.

Send the coupon or write for proof of Curtis economy — today.

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Please send me booklet "How Air Is Being Used In Your Industry."

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RECLAIM UP TO 98.6% OF YOUR CUTTING OIL

Tolhurst Chip Wringers recover as much as 98.6% of oil from chips through the application of centrifugal force. No steam is used, thereby eliminating any loss of oil through emulsification. Unskilled help can operate Tolhurst Chip Wringers efficiently.

REDUCE TOOL WEAR — Tool room records show reductions in tool wear of as much as 50% after installing Tolhurst equipment. The plentiful supply of reclaimed oil results in a more generous and conscientious use of cutting oil. Tools require less attention. Production goes on uninterrupted. Accuracy is maintained. If your machine tools are used in vital war production, investigate Tolhurst Chip Wringers for conserving cutting oil — reducing tool wear. *Write or wire for FREE bulletin.*

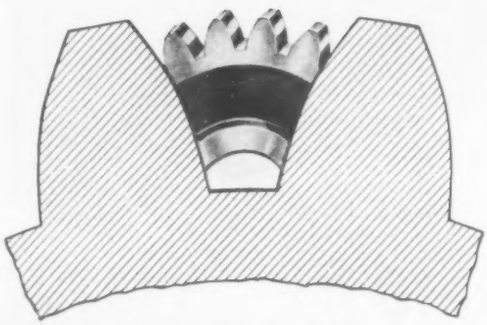
TOLHURST

CHIP WRINGERS

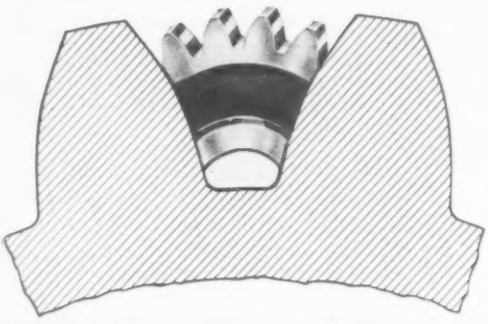
Division of American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

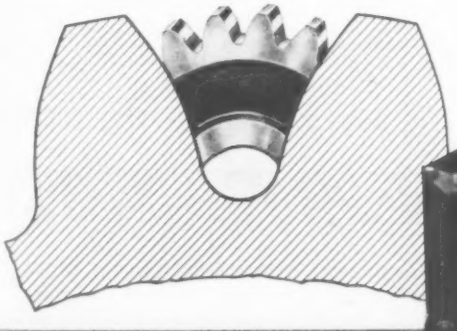
FORMED WHEEL GRINDING CONTROLLED ROOTS ...



STRAIGHT ROOT



DEFINITE RADIUS FILLETS



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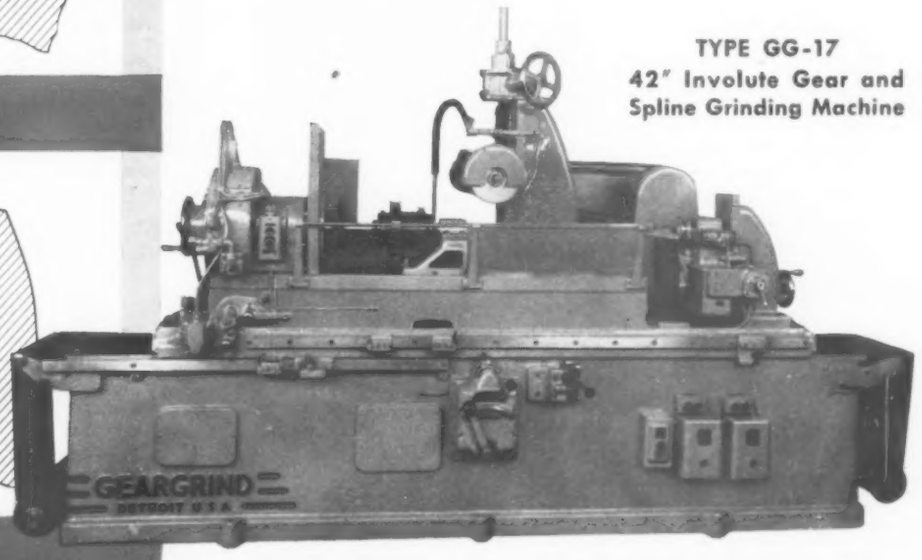
GEARGRIND Formed Wheel Grinders give you definite control of roots—just what your gear design calls for. Full radius roots and definite radius fillets that give absolute line continuity for carrying the greatest possible loads—or plain, straight roots—**GEARGRIND** handles them all.

For external and internal gears, external and internal involute splines, straight splines, serrations and racks, you can count on **GEARGRIND** for *absolute control,* constant production and the finest possible finish. Write today for full information.



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42" Involute Gear and
Spline Grinding Machine

The GEAR GRINDING MACHINE COMPANY
DETROIT, MICH. U.S.A.

COMET

• SPEEDS-UP PRODUCTION

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ONE HAND CONTROL
One hand controls the CM Comet—the other is FREE to guide the load into position.

SPEEDY
Fast, positive lifting and lowering of the load. Requires but a minute or two to hook up.

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Low initial cost . . . low operating cost. Just a few cents a day operates the Comet.

PLUG IN ANYWHERE
No special outlets or wiring needed . . . just plug into the nearest outlet—then hoist.

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It's portable . . . easily removed and installed as it goes from job to job.

In thousands of progressive plants, speedy Comet Portable Electric Hoists are now used to keep machines at peak production. Costly interruptions—waiting for materials—have been eliminated. Production output is accelerated by using Comet Hoists on trolleys, monorails and cranes to lift and transport loads overhead. Wherever careful checks are made, Comet Hoists can always point to an important lessening of worker fatigue. With a minimum investment, a few cents a day for operation, and the simplest operating routine—just plug in the Comet Electric Hoist and it goes to work—you can *step up* efficiency, save valuable floor space and *cut down those "hidden" costs.*

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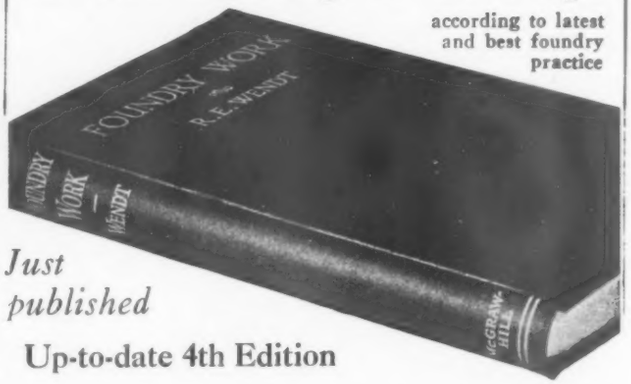
Branch Offices: NEW YORK • CHICAGO • CLEVELAND

Let a veteran foundry man show you

how to handle every detail in the making of castings

according to latest and best foundry practice



Just published

Up-to-date 4th Edition

FOUNDRY WORK

By R. E. WENDT, Head Instructor in Foundry Practice, Purdue University. 261 pages, 4¾x7¼, 229 illustrations, $2.00

HERE is a clear-cut, useful explanation of modern foundry practices, methods and processes. The material plainly and soundly covers the making of all types of castings, describes the apparatus and materials used, and explains the operations and techniques involved. Special material has been added to this edition on bench and floor molding, causes of defective castings and methods of preventing defects, safety precautions, etc. A good deal of down-to-earth attention has been given to problems of foundry management.

Pocket-size, easy to read and refer to, containing over 200 illustrations, this practical book makes clear each step in the production of all the following general classes of castings:

—common gray cast iron
—alloy gray cast iron
—malleable cast iron
—common steel
—alloy steel
—non-ferrous metal

It thoroughly covers everything from fundamentals to what the efficient foundry executive should know in order to solve varied problems — from tools, equipment, sand, flasks, furnaces, fuels, to foundry layout—from cupolas to cleaning and grinding castings.

Latest methods and practical details on:

—foundry layout
—flasks, boards, clamps and weights
—molding sands
—parting materials
—bench and floor molding
—machinery used in molding
—dry-sand coremaking
—preparing, charging and operating the cupola furnace
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—making gray iron mixtures
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and scores of other topics

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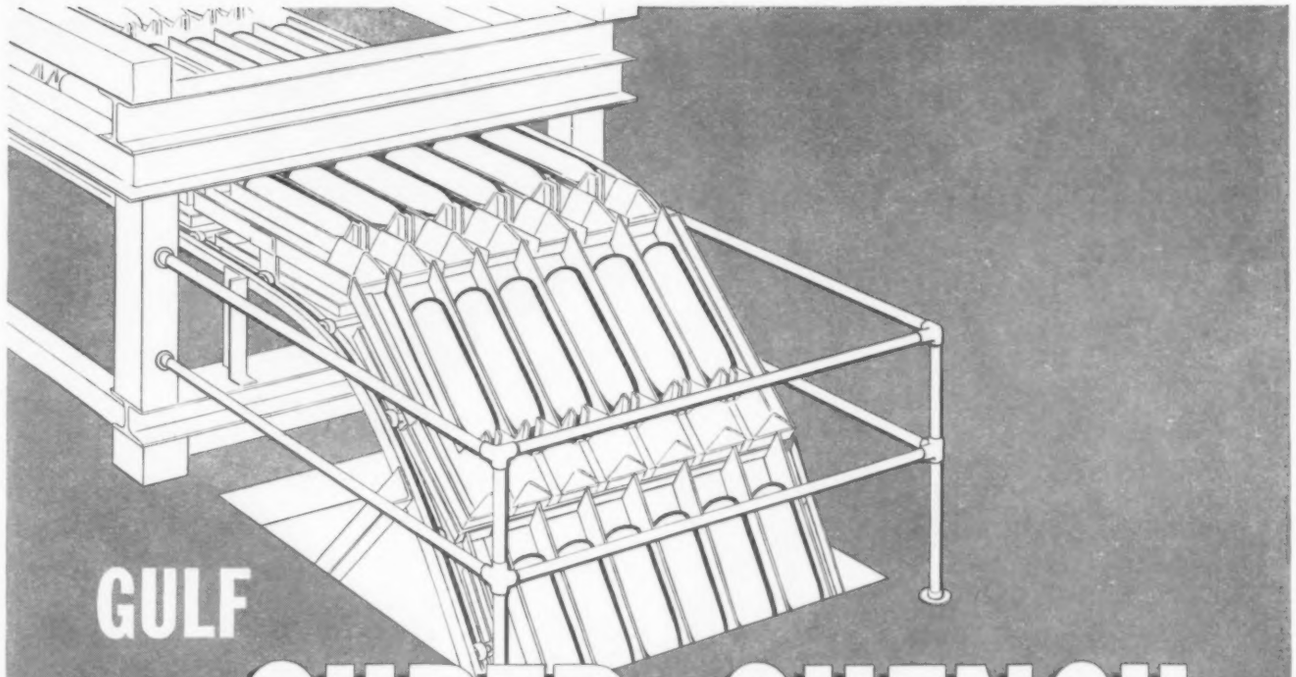

GULF SUPER-QUENCH

has "reserve" quenching power

With dual-action, SUPER-QUENCH in many instances achieves results unobtainable with conventional quenching oils.

Gulf SUPER-QUENCH dual-action provides:

1. A faster cooling rate through the hardening temperature range.
2. The slow speed of conventional quenching oil below the hardening temperature range.

THE National Emergency Steels, developed to alleviate the shortage in critical alloying materials, contain lower and different alloy contents, and as a consequence their use without essential lowering of previous standards for physical properties has created many heat treating problems.

The answer to these problems may be the *reserve* quenching power provided by Gulf SUPER-QUENCH. For SUPER-QUENCH has a faster cooling rate through the hardening temperature range, yet it retains the slow speed of conventional quenching oil below the hardening temperature range. Result: maximum physical properties, with the minimum distortion of oil quenching, which better prepares you to make full use of the new steels.

Gulf SUPER-QUENCH has been engineered solely for quenching metals. Developed through extensive research over a period of years in Gulf laboratories, SUPER-QUENCH has been proven by service in the field—on different types of steel, and on various shapes. In many instances, the improvement in physical properties obtained has been truly remarkable.

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Gulf engineers are at your service in 30 states from Maine to New Mexico to consult with you on your quenching problems.

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Without obligation, please have a Gulf engineer call to consult with us on our quenching problems.

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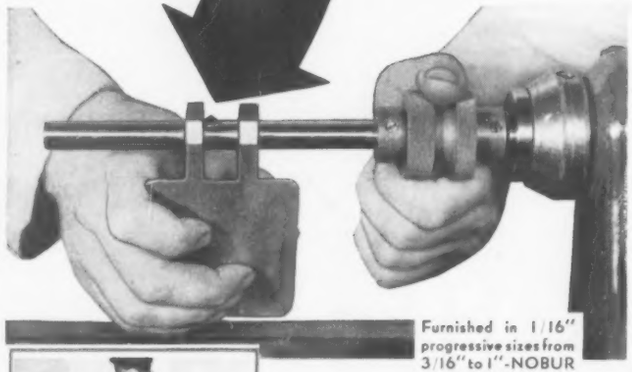
New NOBUR TOOL makes burring a machine operation!



Furnished in 1/16" progressive sizes from 3/16" to 1"-NOBUR TOOLS are the economical solution to your burring problems

NOBUR used on FLEXIBLE SHAFT!

NOBUR burr removing TOOLS are used on any machine tool lathe, drill press, portable electric drill or at the end of a flexible shaft

Removes burrs from inside and outside edges as fast as parts can be handled!

USED on *any machine*, the smooth, clean, cutting action of the NOBUR will pass the most critical inspection. NOBUR is a time-saving, mistake-saving shop tool that eliminates slow, costly hand methods of burring. It lowers production costs and increases production by hastening approval of finished parts. Easy to operate ... no skilled help is necessary... green 'trainees' or women operators can do burring with speed and accuracy... NOBUR minimizes costly reworking and enables the operator to do more in less time... NOBUR is simple in construction... rugged... important parts are hardened and ground... shaft is finished to a diameter slightly under its basic size... double-edged cutting blade is of special tool steel, cuts freely in either alloy steels or soft metals. Order through your distributor NOW ... or write for literature direct to the

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904 NORTH ORANGE DRIVE
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NO/BUR TOOLS

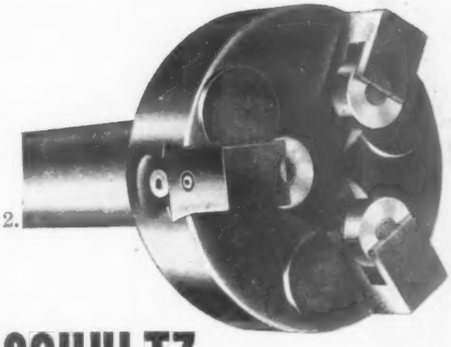
NOBURing—IN AND OUT ...AND THE BURR IS OFF!

★ Boyar-Schultz MODEL "A" BOX TOOL

Available in sizes 00, 0 and 2; Right or Left Hand.

★ Boyar-Schultz MODEL "C" BURNISHING TOOL

Available in Sizes 00, 0 and 2.



BOYAR-SCHULTZ TOOLS FOR SCREW MACHINES

Boyar-Schultz Box Tools are designed and built to take full advantage of the production speed that is built into your screw machines. Their sturdy design, simple adjustments and fine workmanship assure strength for heavy production, speed for quick set-up and accuracy for close work.

MODEL "A"—Easy to set up. Has positive, accurate adjustments. Tool bit is always tangent to work and is quickly reset after regrinding. Wide cutting range permits turning a large variety of shapes and sizes.

MODEL "C"—Burnishing Tool, an ideal Tool for producing a surface smoother than the usual machined surface.

Write for Literature Describing these tools

BOYAR-SCHULTZ CORPORATION
2109 WALNUT STREET CHICAGO, ILLINOIS

The New Cleveland Rigidhobber

SPECIFICATIONS FOR MODEL 3616

Floor Space, including door swing.....54" x 160"
Maximum Diameter Spur Gears.....36"
Maximum Diameter Helical Gears.....27"
Minimum Center Line Work & Hob Arbors....3"
Maximum Hob Diameter.8"
Diameter Work Table...24"
Diameter Index Gear....26"
Rated Max. Dia. Pitch.....3
Height Overall .....100"
Weight .....18,000#
36" dia.—16" travel—20" long

THE CLEVELAND HOBBING MACHINE CO.
CLEVELAND · OHIO

RIVETT

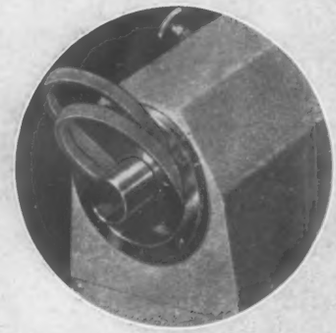
715 PLAIN BENCH LATHE

Power and Speed Range Are Combined with Precision for Greater Earning Capacity

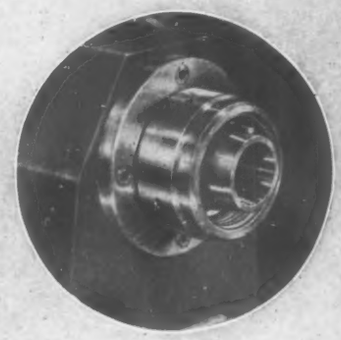
The Rivett No. 715 Bench Lathe fulfills two distinct functions: the production of small duplicate parts requiring extreme accuracy, and the finishing and fitting of fine elements in assembly, maintenance, tool room and laboratory. Various attachments extend its usefulness, and each employs the inherent truth of the preloaded ball bearing spindle. The attachments include, besides compound slide rest and tailstocks, universal grinding attachment and milling attachment. The unit motor drive provides eight selective spindle speeds and may be used with either steel cabinet or bench mounting.

The original accuracy built into the No. 715 is protected for years of normal use. The enclosed headstock provides rigid, vibrationless mounting for the super-precision ball bearings. All revolving parts are dynamically balanced. The self-centering design of the long taper key-drive spindle nose guarantees true running chucks and face plates. Steel top slide and full depth Acme feed screws make for an enduring compound slide rest. All vee belts are replaceable without disturbing lathe or drive assembly or removing spindle from its bearings.

715 PLAIN BENCH LATHE



Replaceable Spindle Belts

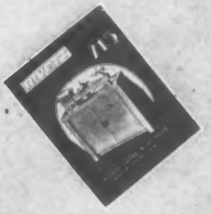


Long Taper Key-Drive Nose

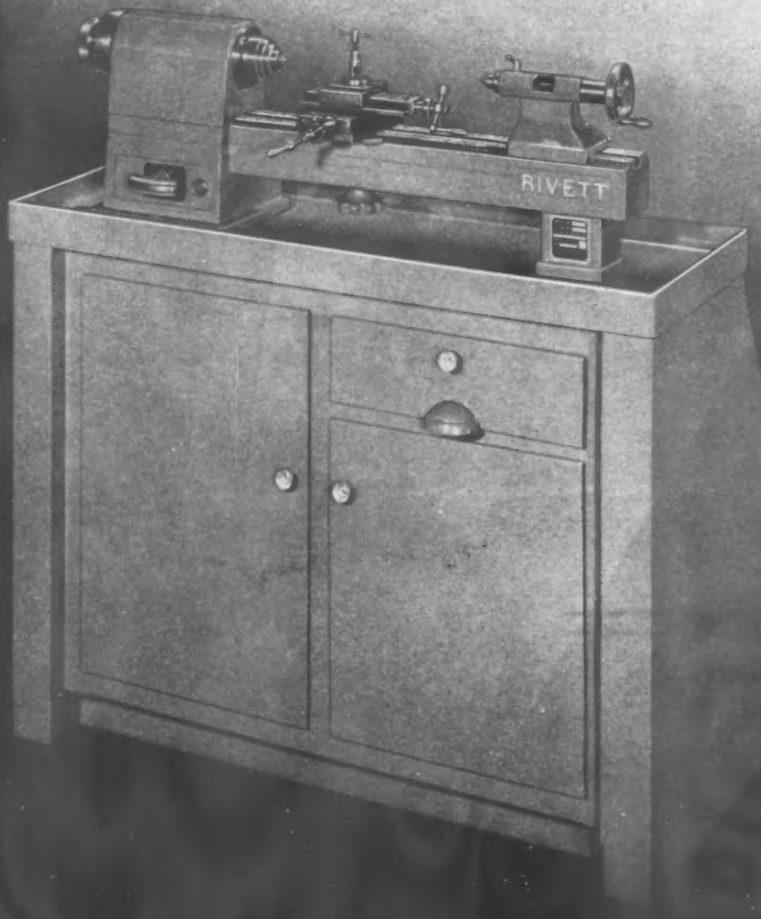
Convenient Drive Control

SPECIFICATIONS

Swing over bed, dia.	7"
Distance between centers	15"
Collet capacity, max. dia.	¾"
Step chuck capacity, max. dia.	5"
Jaw chuck capacity, max. dia.	4"
Spindle capacity, max. dia.	55/64"
Slide rest, travel of tool post slide	4¼"
Slide rest, travel of cross slide	5"
Tailstock spindle travel	3"
Spindle speeds: Eight forward and reverse	150 to 3500 r.p.m.
Weight of lathe, mounting and drive, net	650 lbs.



For Further Description
Write for Bulletin 715



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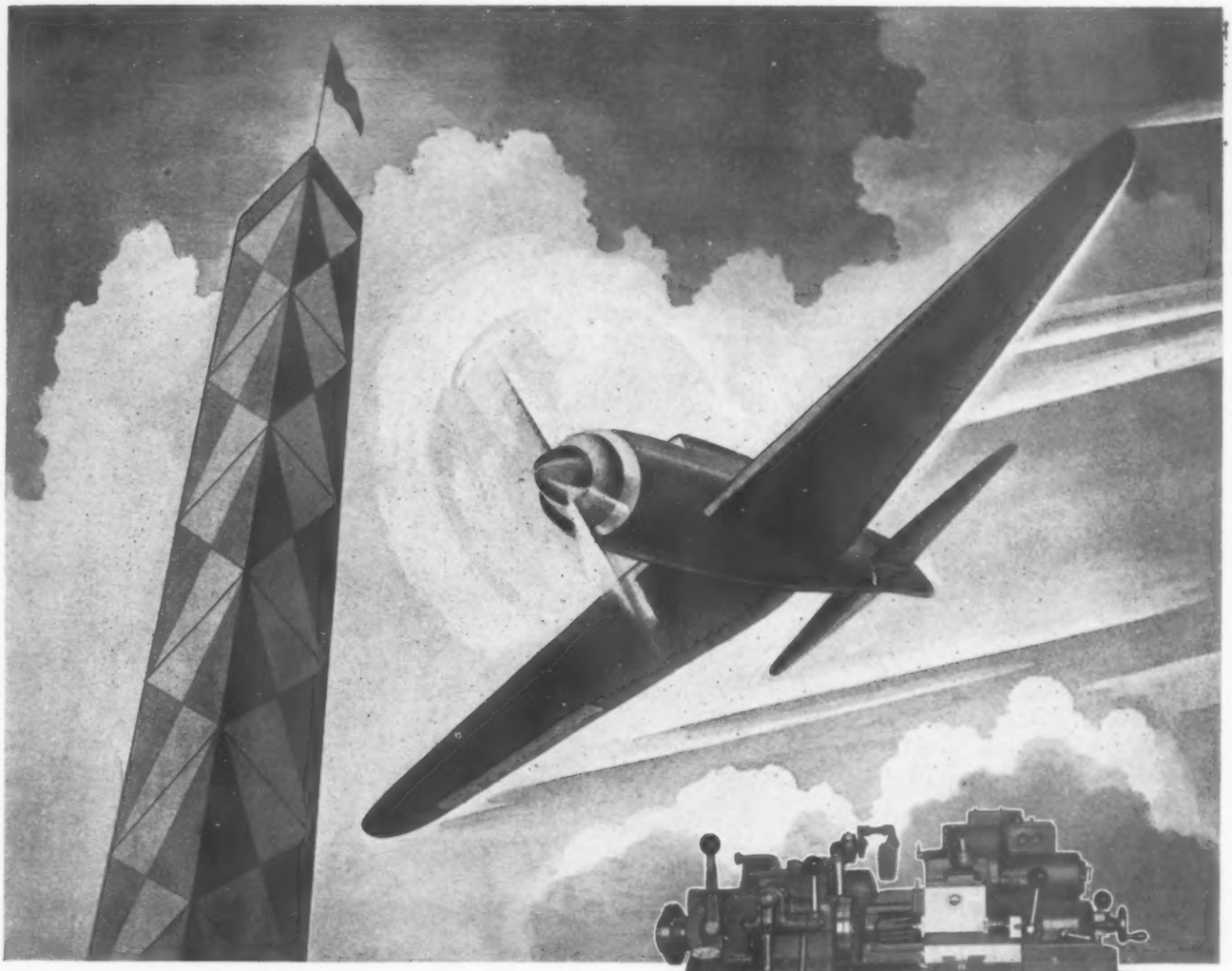
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT



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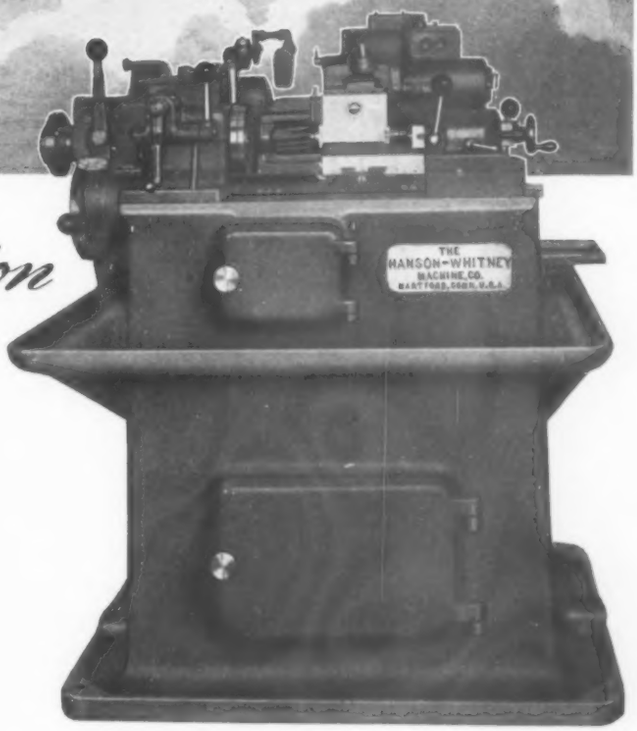
H-W Universal Semi-Automatic Thread Milling Machines are modern in every detail . . . will enable you to produce perfect, close-limit work without spoilage. The H-W Milling Process permits the working of many previously hard-to-thread materials . . . and, by applying the multiple cutter principle, threads of all lengths within the capacity of the machine are completed in one revolution. External, internal and taper threads . . . right or left hand . . . can be cut with equally high speed, precision accuracy and convenience. If you have a threading problem call Hanson-Whitney.



Hanson - Whitney 4 x 9" Semi-Automatic Thread Milling Machine.

The HANSON WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.

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CAPACITIES:
20,000 Lbs.
20 inches away from table
8 inches off center

CAPACITIES:
30,000 Lbs.
24 inches away from table
18 inches off center

These new giant C-F POSITIONERS (the one illustrated is the smaller) make the handling of really big work easy. With a few push buttons a welder can rotate his weldment or assembly in a complete 360° circle, can tilt it at any angle thru an arc of 135° off horizontal, can move it thru both planes at once to save valuable minutes, and stop it at any point so that welds on all surfaces can be made down-hand —can have strong, smooth, flawless fillets.

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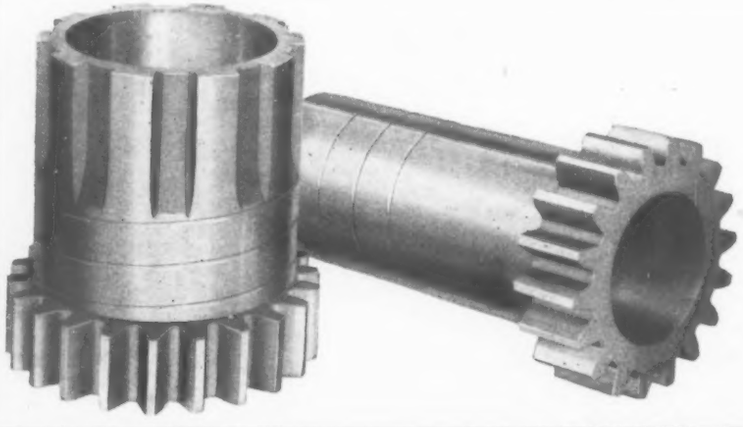

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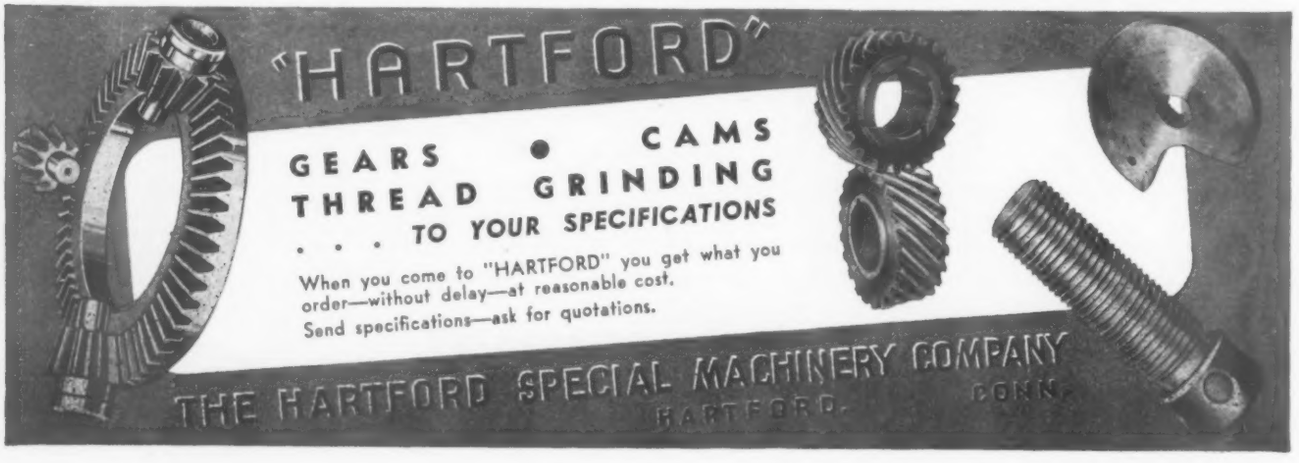
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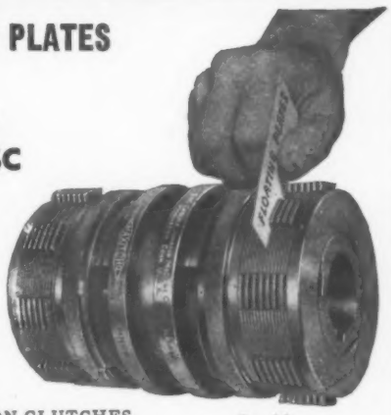

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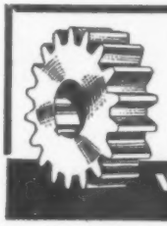

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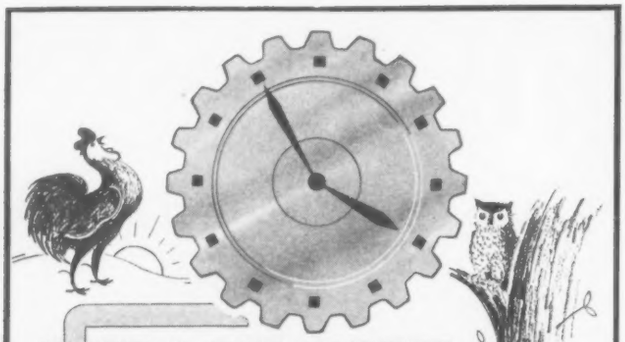

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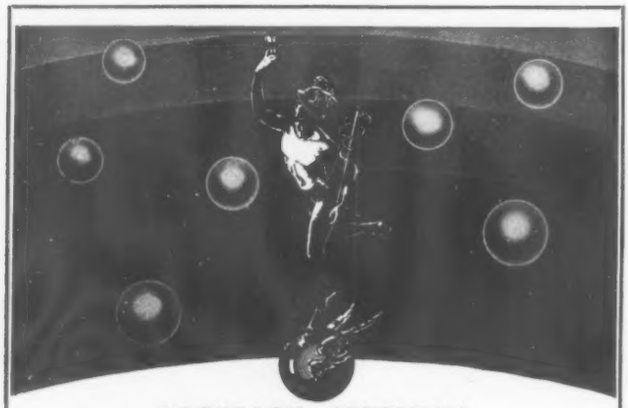

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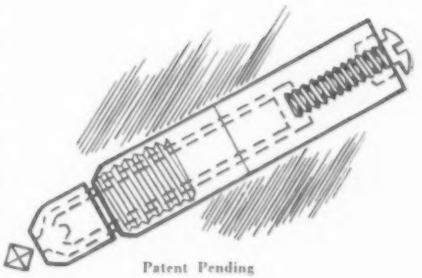

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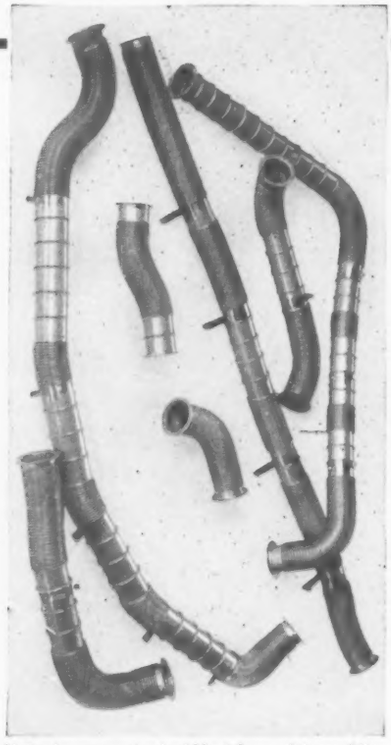

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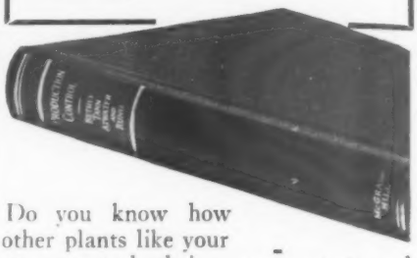

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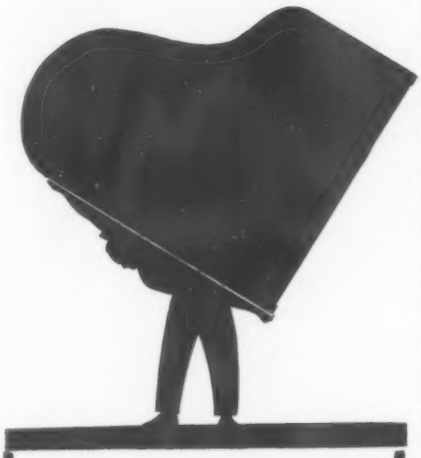

MOVING?

If you plan to change the address to which your copies of *American Machinist* are sent, let us know now. We don't—and we're sure *you* don't—want a single issue to be delayed in reaching you. Coupon below for your convenience.

AMERICAN MACHINIST

330 W. 42 St., New York

▲ ▲ ▲

MY OLD ADDRESS

Name .....

Title .....

Company .....

Address .....

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MY NEW ADDRESS

Name .....

Title .....

Company .....

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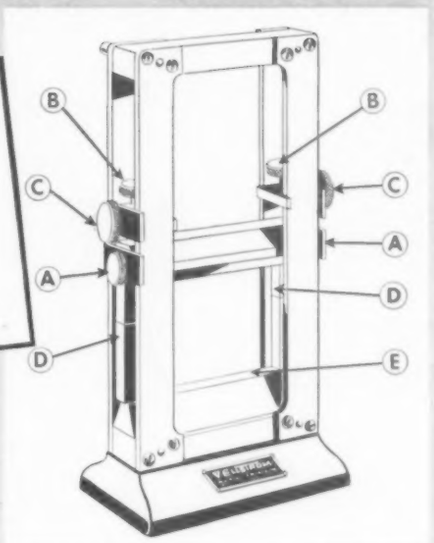
Increase your efficiency in setting your Internal Indicators



Above is a photograph of the Ellstrom Gage with the indicator being set at 3". To insure the ultimate in accuracy, each Ellstrom Gage is constructed of the finest steel with gaging surfaces that are processed and finished to millionths in flatness. For prices and delivery information wire or write today.

THE diagram drawing above shows the Ellstrom Gage set at 3" and the key explanation below gives the adjusting procedure.

Screws A on upper parallel bar have been carefully adjusted and need not be touched. In raising or lowering the bar loosen only screws C, then place fingers on screws A, and move bar upward or downward as the case may be, but without turning the screws.

Allow room to place the gage blocks on lower parallel between the posts of the gage. Then lower bar until its surfaces and those of the blocks fit snugly without any forcing. Tighten screw C lightly and evenly. Screws B are then used to apply slight pressure in making final adjustment.

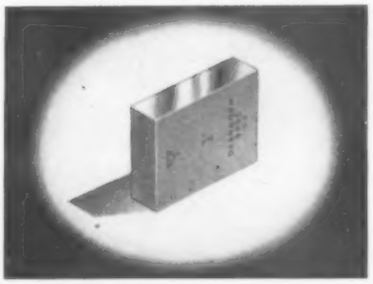
D gage blocks E stationary parallel

Originators of Chromium Plated Gage Blocks

DEARBORN GAGE COMPANY 22035 BEECH STREET DEARBORN, MICHIGAN

For longer wearing Millionths

• It has been definitely established through tests made by the National Bureau of Standards that the wear resistance of finished chromium plate is much greater than that of hard steels. Consequently, Dearborn chromium-plated gage blocks are recognized as longer wearing standards. Dearborn blocks are available in standard accuracies from ± .000008" to ± .000002"



McCaskey Control in use in crib of Harley-Davidson Motor Company, Milwaukee

McCASKEY TOOL CRIB CONTROL

assures...

MORE PRODUCTION with LESS TOOLS

★ SAVE TIME AT THE TOOL CRIB AND INCREASE PRODUCTIVE TIME

Whether you have one or a dozen tool cribs, McCaskey Tool Control assures big time-savings. By eliminating much of the waiting time ordinarily lost at the crib window, each employee drawing tools is back at the job on his machine quicker, reducing his idle time and that of his machine.

The more men in your shop and the more machines on your production lines, the greater the tool saving in man hours and the greater the increase in productive machine hours realized with the McCaskey system. Faster tool service is but one of many practical advantages offered by McCaskey.

The superintendent of a well known plant writes "Under the brass check system we could handle 60 transactions an hour per crib attendant. With the tool requisition system (McCaskey) we can handle as many as 125 per hour."

KEEP TOOLS IN CIRCULATION AND REDUCE TOOL INVENTORIES

McCaskey Control also provides the means for checking in a moment where each tool is—whether in an employee's tool box or at his machine—whether idle or at work—and *how long it has been out*. Employees are easily prevented from hoarding tools that should be in the crib available for use.

Not only is no time wasted locating tools needed for another job, but fewer tools actually are required because *they are constantly available for service*. With increasing delays and difficulties experienced securing new tools today, tool availability is a vitally important factor in meeting production requirements.

From The Chain Belt Company, Milwaukee, Wisconsin—"McCaskey Tool Control gives us complete control of the tools in our cribs. Tools are promptly returned when an operation is completed. The tool inventory has been reduced and breakage eliminated."

• • • •

McCaskey Tool Control can be quickly and easily applied to your particular needs. Both crib attendants and employees like it far better than the antiquated check methods it usually replaces. A McCaskey representative is at your service to analyze your needs and offer practical suggestions.

THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems, Ltd., Galt, Ontario, Canada. *The McCaskey Register Co., Waterford, England.*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

Magni-Ray

MADE IN U.S.A.

meets many needs for an

ILLUMINATED MAGNIFIER

MAGNI-RAY
MODEL A

This instrument especially developed for close inspection, quickly detects costly and troublesome sources of delay and waste by giving clear, undistorted magnification combined with strong, evenly concentrated illumination.

Typical uses include examinations for

. . . burrs and poor finish on small parts, screws, pins, etc.

. . . cracks in steel after hardening.

. . . imperfect welding seams.

. . . blow holes in castings for machine tool beds, tools and dies, etc.

Magni-Ray provides an unusually wide magnification field as well as exceptionally high power magnification for such a field. Defects, not apparent to the unaided eye are quickly revealed. Outside reflections are completely shut off and illuminating bulbs shielded so that no light rays are thrown back into the eyes of the operator. Quick removal from stand and easy attachment to machine tool makes it possible to use Magni-Ray for close watching of work during machining. Ready for immediate use by merely plugging in to the nearest 110 volt lighting outlet. A universal clamping attachment as well as both horizontal and vertical adjustment assure maximum convenience in use for a wide variety of applications.

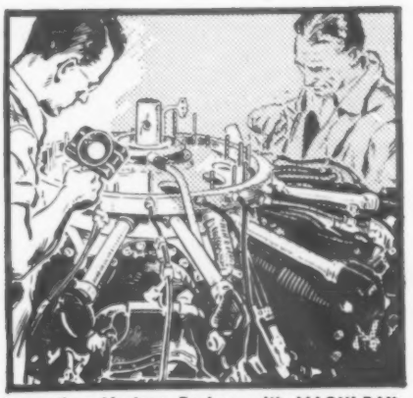
Magni-Ray not only provides a valuable addition to your inspection equipment, but can be used to advantage in your receiving department, tool room, shop, drafting room and assembly line.

MADE IN TWO MODELS

Model A. Consisting of MAGNI-RAY Unit with 3-inch optical glass lens, complete with illuminating bulbs, electrical equipment, swiveling clamp and stand. Price $18.50.

Model B. Consisting of MAGNI-RAY unit with a chromatic lens field of 2 inches and magnification power of 3 plus, complete with bulbs, electrical equipment, swiveling clamp and stand. Price $27.50.

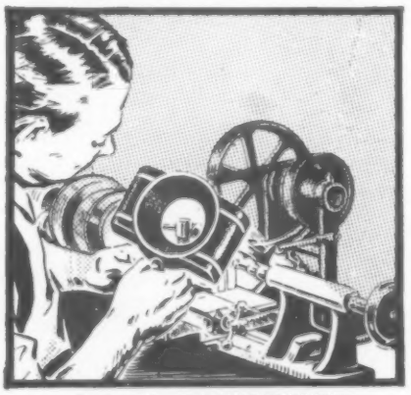
ORDER TODAY. PRIORITIES REQUIRED



Inspecting Airplane Engines with MAGNI-RAY

MAGNI-RAY used for inspection of riveting, welding, etc.

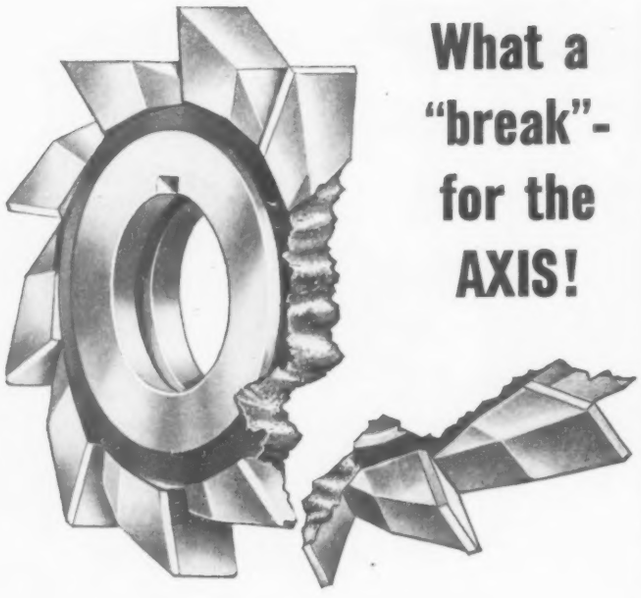
Examining small parts with MAGNI-RAY



Tool setting with MAGNI-RAY

GEORGE SCHERR COMPANY, INC.

124 LAFAYETTE ST.,
NEW YORK, N. Y.



What a "break"- for the AXIS!

Two things will greatly reduce tool breaks:

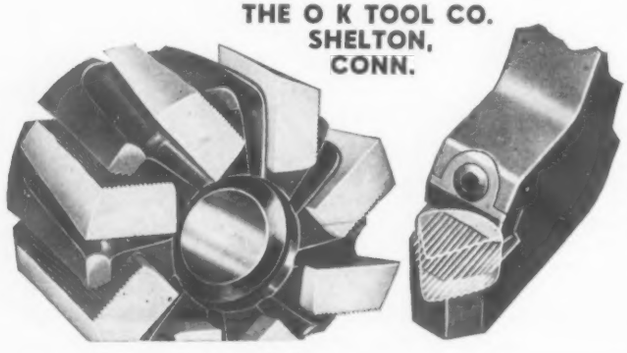
(1) CARE IN THE USE OF TOOLS—This goes for *all* tools from twist drills up to giant milling cutters, the breaking of which can tie up a whole department.

In setting up milling jobs, watch the "little" things. Select a cutter big enough for the job. Mount it right. Check and re-check speeds. Don't nick the cutter in taking it down, nor heave it onto a crowded bench. In short, don't miss a trick anywhere. Tools are "guns." Keep 'em working!

(2) CARE IN THE PURCHASE OF TOOLS—Insist on up-to-date tools, particularly in milling cutters and single-point tools. In the O K Inserted-Blade types only the edges are made of H. S. steel; the bodies are drop-forged steel, ruggedly proportioned.

If a tooth in a solid cutter breaks, a repair (if possible) is generally a time waster. If a blade in an O K cutter breaks, a new one is quickly inserted. O K Tools are available only on priority. If interested, please contact us now.

THE O K TOOL CO.
SHELTON, CONN.



TRADE O K MARK **SYSTEM**
OF INSERTED-BLADE METAL CUTTING TOOLS

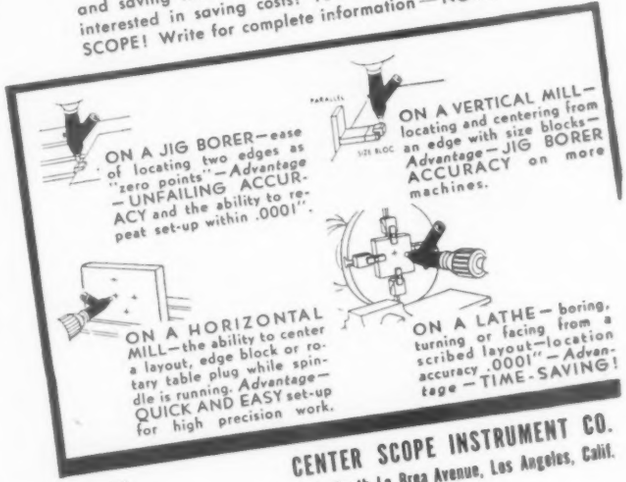
THE CENTER SCOPE

–is an optical locating and centering tool–that can be used on any machine!

The CENTER SCOPE is a shop tool—a rugged yet accurate precision measuring instrument with 45x magnification that helps every machinist to ACTUALLY SEE THAT HE IS RIGHT!

Its easy, accurate, quick precision eliminates human errors in tooling. Used 'on the job'—it's not affected by wear, temperature or mechanical pressure. It's a time-saving, mistake-saving, optical instrument with which you can locate edges or layouts to spindle axis 'within a tenth'—you can set-up faster and easier—you can compensate for spindle or adaptor run-out—and you have added confidence to go ahead with machining at a faster rate.

To the machinist, to the shop foreman, to the average operator—CENTER SCOPE is a necessary production tool—necessary today because you are interested in war production and saving time—necessary tomorrow because you will be interested in saving costs! You can't "miss" with a CENTER SCOPE! Write for complete information—NOW!


ON A JIG BORER—ease of locating two edges as "zero points"—Advantage—UNFAILING ACCURACY and the ability to repeat set-up within .0001".
ON A VERTICAL MILL—locating and centering from an edge with size blocks—Advantage—JIG BORER ACCURACY on more machines.
ON A HORIZONTAL MILL—the ability to center a layout, edge block or rotary table plug while spindle is running. Advantage—QUICK AND EASY set-up for high precision work.
ON A LATHE—boring, turning or facing from a scribed layout—location accuracy .0001"—Advantage—TIME-SAVING!

CENTER SCOPE INSTRUMENT CO.
353 South La Brea Avenue, Los Angeles, Calif.

FREE OPERATING MANUALS!
1. The CENTER-SCOPE and its Operation.
2. The CENTER-SCOPE and Optics.

AN EYE FOR ACCURACY

JOHNSON UNIVERSAL BRONZE

How you can

Avoid Waste

When you purchase bronze bars, you can help conserve precious metal . . . save considerable machine time . . . eliminate trouble by specifying Johnson UNIVERSAL Bronze.

Every Johnson bar is completely machined — I. D.— O. D.— and ENDS. This enables you to cut your parts with the lowest possible waste. The range of sizes —over 350 solid and cored—permits you to buy *exactly* to your needs.

Start now to help conserve the nation's supply of metals. Specify Johnson UNIVERSAL on your next order. Compare it with any you have ever used. See for yourself how much you can save on each bar. Your local Johnson distributor carries a stock. Write for a copy of our size list and the location of your nearest source of supply.

JOHNSON BRONZE COMPANY

Sleeve BEARING HEADQUARTERS

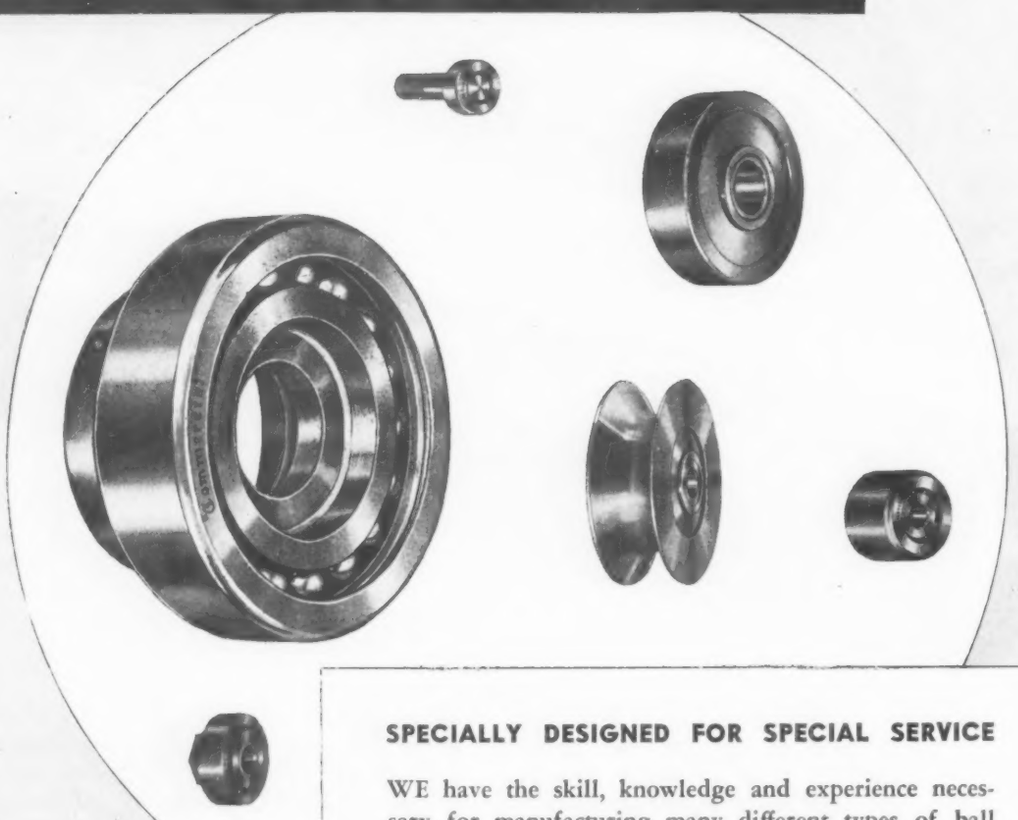
515 SOUTH MILL STREET • NEW CASTLE, PA.

"Commercial"
ANNULAR BALL BEARINGS

ACCURATE

STRONG

STURDY



BALL BEARINGS FOR EVERY PURPOSE

SPECIALLY DESIGNED FOR SPECIAL SERVICE

WE have the skill, knowledge and experience necessary for manufacturing many different types of ball bearings such as we illustrate on this page.

"Commercial" Annular Ball Bearings are used in widely diversified products—cultivating machines, typewriters, textile machinery, radios, scales, coal mine conveyors and other uses too numerous to mention.

SCHATZ **"Commercial"** Ball Bearings are famous for uniformly good workmanship, load capacity and endurance. Send for latest catalog.

THE SCHATZ MANUFACTURING CO.

POUGHKEEPSIE, N. Y.

Detroit Office: 2640 Book Tower • Chicago Office: 902 S. Wabash Ave.
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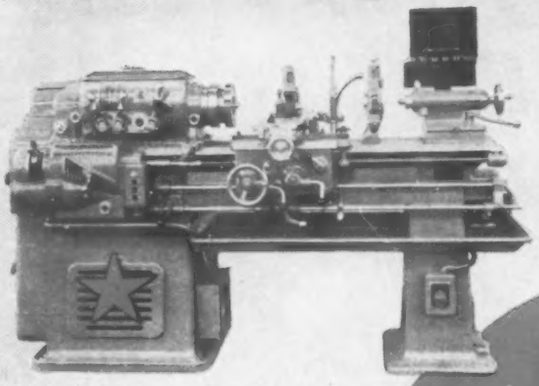
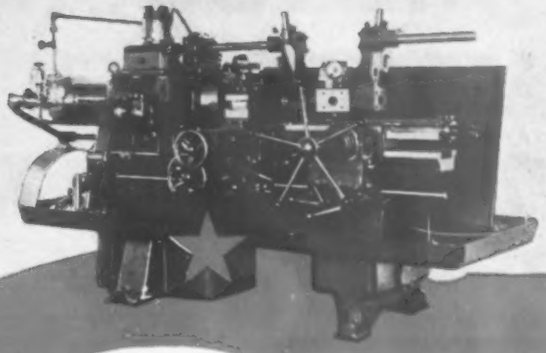
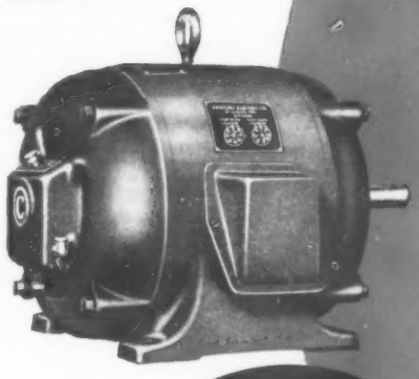
Quietly and Unseen ★





CENTURY MOTORS
power the precision production of thousands of machine tools



Century Motors are the unseen dependable servants of thousands of operators of machine tools engaged in War production. Because of their unusual freedom from vibration, Century Motors do not handicap the precision of the machine tool.

From the largest machines involving heavy shock loads to the smallest of precision machine tools, you'll find Century Motors standing the gaff of continuous, 3-shift duty — they are engineered to meet the demands of such service.

The wide range of Century Motor types and sizes can well save *you* time and money by simplifying proper motor selection. For assistance in the quick solution of your motor problems, call in your nearest Century Motor Specialist without delay.

CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Mo.
Offices and Stock Points in Principal Cities

Century MOTORS

One of the largest Exclusive Motor and Generator Manufacturers in the World.

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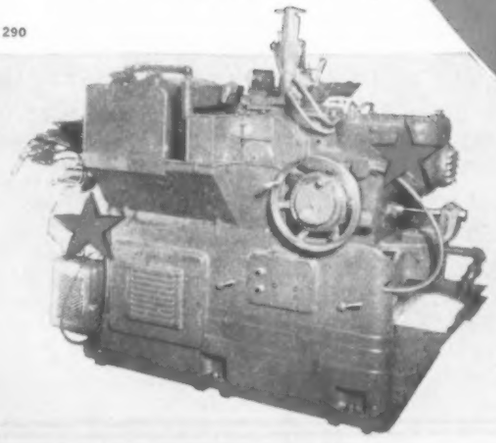
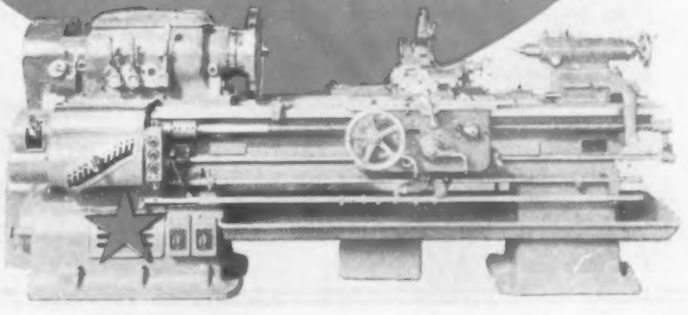
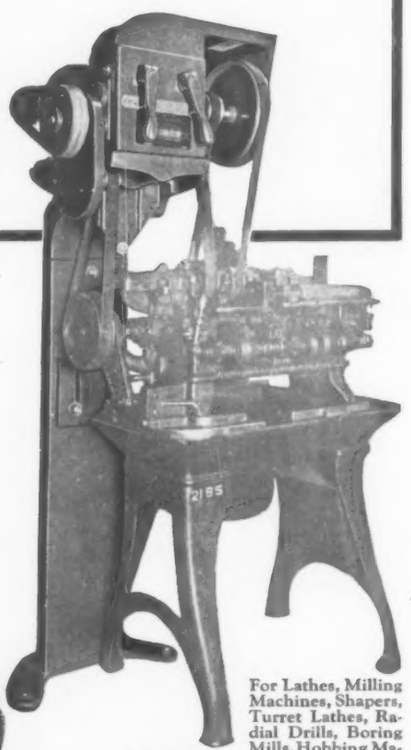




THE TOUGHEST, FASTEST, *MOST EFFICIENT* GEAR BOX DRIVE *A Man Can Ask For!*

TURNER UNI-DRIVE

Motorizes Machine Tools



For Lathes, Milling Machines, Shapers, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools ...also Brown & Sharpe and Cleveland Automatic Screw Machines.

The old way is too slow today. More speed... greater production ...you must have them to keep apace! Enlist the aid of TURNER UNI-DRIVES. They'll increase production like an extra shift... save time... speed up work... keep down power costs. They're doing it in scores of shops and plants. They'll do it in yours. TURNER UNI-DRIVE is the *successful* motor drive.

Easily and quickly installed. They do away with overhead counter shifts... no belts to shift. Increase the efficiency of machine and operator. Drive on large cone at all speeds. One trial will thoroughly convince you. Right now—today... investigate TURNER UNI-DRIVE. See your dealer, or write or wire us for full information.

THE TURNER UNI-DRIVE COMPANY
(Sales Division: Turner Machinery Company)
3416 Terrace St. **Kansas City, Mo.**

(5)

SOME USERS OF
TURNER UNI-DRIVE

American Brake Shoe & F. Co.
Kellogg Division
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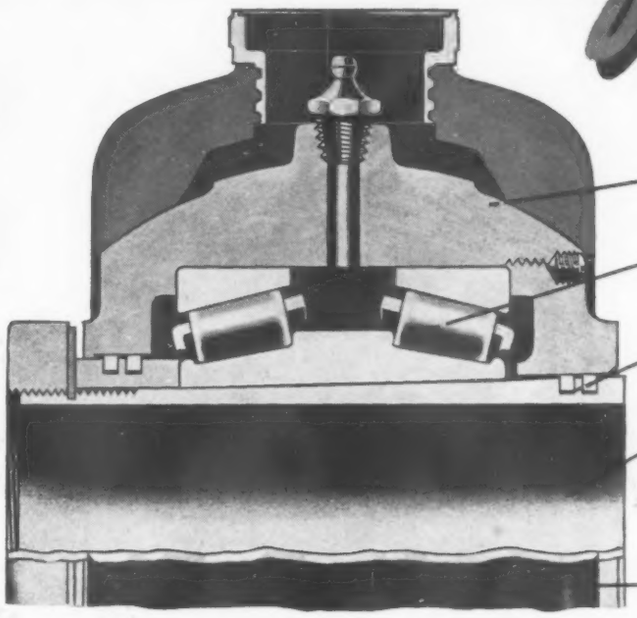
They Can Take a Beating *for Victory!*

HIGH SPEEDS
HEAVY DUTY
SHOCK LOADS



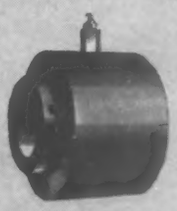
1. ● Full ball and socket self alignment.
2. ● Timken tapered roller bearings give full radial and thrust capacity.
3. ● All metal automotive type piston ring seals keep grease in and dirt out.
4. ● Long split adapter sleeve distributes load over entire length of bearing — reduces pressure per square inch on shaft and eliminates peening action which causes rapid wear.
5. ● Rugged, well proportioned outer housing.

DODGE-TIMKEN SPECIAL DUTY BEARINGS

Dodge-Timken Special Duty Ball and Socket Pillow Blocks

Dodge-Timken Special Duty "S 1" Pillow Blocks

Dodge-Timken Special Duty "D" Unit Mount



Dodge-Timken Special Duty "B 1" Unit Mount

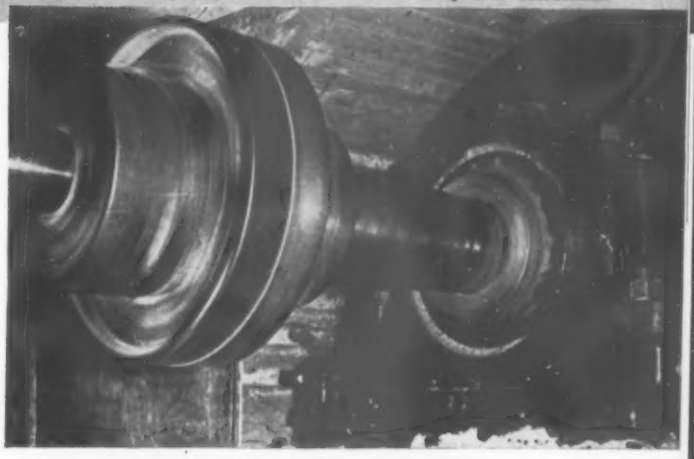
Dodge-Timken Special Duty "S 1" Unit Mount

DODGE-TIMKEN bearings can take the beatings handed out by today's 24-hour production on week-in and week-out schedules. They are designed to give a minimum of 30,000 hours of service under conditions for which they are adapted.

Available in a wide variety of sizes and types — Dodge bearings offer lubricating features that guard against possible neglect by "green" shop help. Indestructible steel seals prevent lubrication leakage — require only infrequent attention from oilers — protect production schedules.

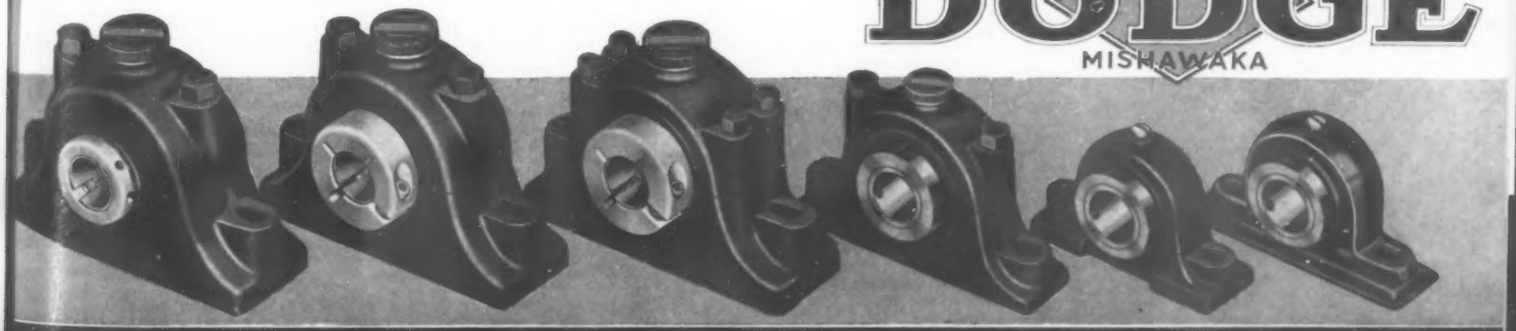
Put all your power into production with Dodge anti-friction bearings — insure unbroken operation with Dodge ruggedness and stamina. Dodge distributors, located in important industrial centers from coast to coast, are prepared to check over your power transmission equipment — help you in the application of the right bearing for the job. Call the one nearest you or write us direct today for Bulletin A 206 and Selection Tables.

DODGE MANUFACTURING CORPORATION
MISHAWAKA, INDIANA, U. S. A.



Dodge-Timken Special Duty Pillow Blocks help modernize power transmission and solve increased production problems in an important North Carolina textile mill.

DODGE
MISHAWAKA



DODGE ROLLING BEARINGS . . . The 30,000 Hour Line

BUILT BY B. F. STURTEVANT CO.

SKF

BALL AND ROLLER BEARINGS

Friction can't invade HERE

Friction doesn't find a chance to marshal an attack on this fan shaft. In its way is an SKF Pillow Block guarding an SKF Spherical Roller Bearing. Water cooled copper coils are embodied in this housing to dissipate the intense gas temperature which is transmitted through the shaft. Ruggedly designed in two halves, this SKF Pillow Block is easy to assemble, inspect and lubricate . . . occupies very little space . . . insures uninterrupted operation 365 days a year, year after year . . . pays for itself in labor, lubricant and maintenance economies within a short time. SKF Bearings and Pillow Blocks are always found where reliable operation is a MUST.

5061

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILADELPHIA, PA.

BROWN & SHARPE
E
We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
B·S

TODAY DEMANDS PRODUCTION *AND* ACCURACY

– Use № 12 Plains for your *quality* milling

B·S

The No. 12 Plain Milling Machines shown above are part of a battery on war production. Simplicity and reliability of operation materially reduces the breaking-in period for new operators wherever No. 12s are used.

- ✓ Automatic Milling Cycles
- ✓ Climb or Conventional Milling
- ✓ Ease of Set-up and Operation
- ✓ Electrical Control

— and many other advantages to mill efficiently on a wide variety of materials

BROWN & SHARPE

...The Knurled Heads

SAVE TIME

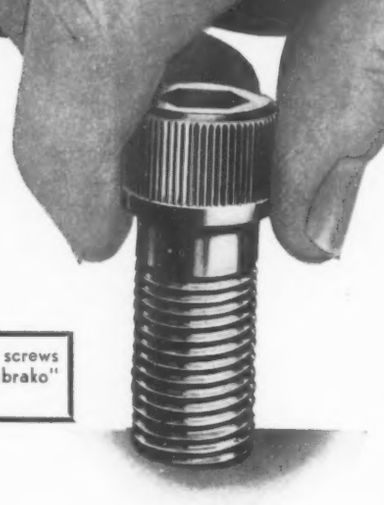
KNURLED

UNBRAKO

Reg. U. S. Pat. Off.

SOCKET HEAD CAP SCREW

Most every mechanic prefers to run a cap screw down as far as he can with his fingers before he reaches for a wrench. To provide him with a better grip, and to save time we, years ago, knurled the heads on the "Unbrako" Socket Cap Screw. On these there is no skidding or slipping, even when the screw is oily or his fingers greasy. This tighter, surer grip means more production per man per day . . . more goods to speed victory.



Knurling of socket screws originated with "Unbrako" years ago.

Note—you pay no more for this added advantage.

UNBRAKO

Self-Locking
HOLLOW SET SCREWS
with Knurled Points

If an ordinary set screw fails to hold, equip with "Unbrako" Self-lockers. The knurled points dig in for the duration just by tightening the screws up as usual. Vibration can't dislodge them, yet they can be easily removed and used again and again.

For more facts about "Unbrako" Screws, write us or see your local distributor . . . chances are he carries them in stock.

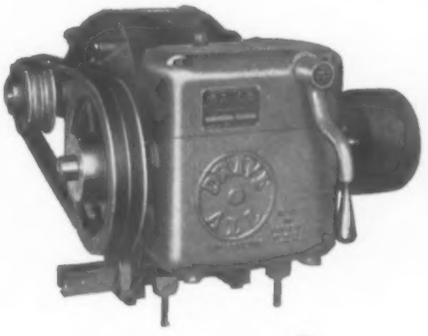
STANDARD PRESSED STEEL COMPANY BOX 4, JENKINTOWN, PENNSYLVANIA

BRANCHES: BOSTON DETROIT INDIANAPOLIS CHICAGO ST. LOUIS SAN FRANCISCO

We Are Now Getting 20, 40 and 80 F. P. M. Cutting Speeds On Our Planers Instead of the Fixed 35 F.P.M. We Had Before We Installed Our DRIVE-ALL UNITS

"Our cast iron, aluminum, brass and monel parts are run at the highest (80 F.P.M.) speed, more than double the previous cutting speed, and the steel parts approximately 14% faster, leaving the 20 F.P.M. for the unusually tough jobs."

A selective speed machine tool transmission that can be installed in approximately 2 hours. Available as Standard Unit, 1 to 5 h.p. and as Heavy Duty 5 to 10 h.p. Both with 3- or 4-speed gear boxes. The Drive-All installation cost in the above typical case totalled about $185, including all necessary electrical equipment. Drive-All prices begin well below this, depending on application.



☐ LATHES AND TURRET LATHES

☐ MILLING MACHINES

☐ GEAR CUTTERS

☐ DRILL PRESSES AND RADIALS

☐ AUTOMATICS

☐ ☐ SHAPERS AND PLANERS

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☐ BORING MILLS

☐ SPECIAL APPLICATIONS

This may be just the solution to your production problems, too. Write for Drive-All Catalog and address of your local representative. We will gladly study your requirements without obligation.

DRIVE-ALL MANUFACTURING COMPANY

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HAND-FINISHING *requires* PRECISION FILES

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For more than 40 years, "American Swiss" Swiss-Pattern Files have consistently maintained a reputation for uniform hardness, clean sharp teeth, and long wear. For better, faster filing insist on "American Swiss" . . . 3,000 different sizes and patterns. Buy from our Distributor.

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MAC-IT Square Head Set Screws
For Jobs Requiring Extraordinary Strength

Mac-it quality square head set screws are made for the toughest kind of holding-down jobs—forming machine bearings, giant axle housings, die clamps, cutting tools, forging machinery, and the like.

Mac-it square head set screws obliged to endure terrific punishment show unusual resistance to upsetting or mushrooming of the points and to breaking off under the heads.

OTHER MAC-IT PRODUCTS INCLUDE:

Socket Head Cap Screws • Hexagon Head Cap Screws • Hollow Set Screws
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THE STRONG, CARLISLE & HAMMOND COMPANY
1392 West Third St., Cleveland · Ohio

HOW AND WHY

WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools*, BUFFALO, N. Y.

WILLIAMS' "SUPERSOCKET" WRENCHES

Since *socket wrenches*, today, play an important part in the servicing as well as manufacture of mechanized war equipment, a general knowledge of standardized types is desirable. Williams' "Supersocket" Wrenches include 5 separate and distinct patterns of *standard drive* sockets, each with its full assortment of handles and parts. A brief description of each pattern follows, together with information on the type of service for which it is designed.

Midget Pattern

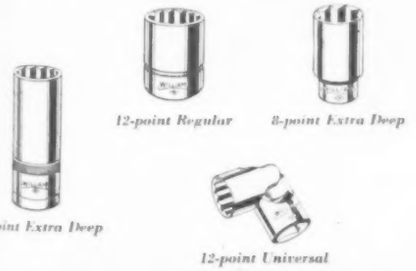
1/4" Square Drive.
Openings, 3/16" to 7/16"

12-point *Hex* *Square*

Slim, straight wall sockets for electrical and all delicate adjustments. Ideal for magnetos, timers, generators, wiring connections, radios, carburetors, etc.

Bantam Pattern

3/8" Square Drive.
Openings, 1/4" to 3/4"



12-point Regular *8-point Extra Deep* *12-point Extra Deep* *12-point Universal*

Light, but strong, straight wall sockets with thin walls for use in close quarters. Universal sockets are fitted with spring tension to maintain desired operating angle. Recommended for aviation and general service.

Standard Pattern

1/2" Square Drive.
Openings, 7/16" to 1-1/4"

12-point Regular *12-point Extra Deep* *Square Regular*

The 12-point sockets in this pattern have straight, thin walls. Those with square openings are the Taper Nose type. Extra Deep sockets have cross hole for use with a bar. Recommended for industrial and general service.

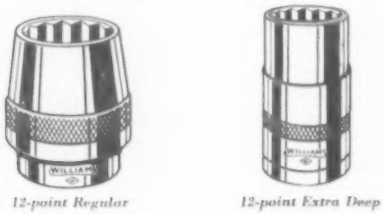
TYPICAL HANDLES & PARTS

(Standard Pattern Illustrated)

S10 & S15: Speeder Handles
S110P & S115P: Extensions
S50: Ratchet Handle
S57: Torque "Measurrench"
S51: Reversible Ratchet Handle
S40, S41 & S42: Flex Handles
S20A: Sliding T Handle
SH130: Adapter. S140: Univ. Joint

Heavy Duty Pattern

3/4" Square Drive.
Openings, 7/8" to 2-1/4"



12-point Regular *12-point Extra Deep*

Designed for harder service where more strength is required than on the "every-day" job, this pattern provides ample strength without clumsy bulk.

Extra Heavy Duty Pattern

1" Square Drive.
Openings, 1-1/16" to 2-3/4"

12-point Regular

Ruggedly designed for the toughest kind of service. Sockets are all cross-drilled to receive sliding handle, which minimizes tendency of socket to "tip" under extreme leverage. "Lock-Socket" device eliminates danger of sockets being detached in service. Ideal for all extremely heavy work including tanks and other mechanical field equipment.

General Characteristics

Speed and *Safety* are inherent socket wrench advantages. "Supersockets", with their innumerable combinations of handles, accessories and drive adapters, provide an extremely flexible wrench system that is speeding war production and the servicing of fighting equipment for land, sea and air.

Williams' "Supersockets" are sold singly and in complete Sets. Write for booklet, "How to Select and Use Wrenches."

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere

PROMOTED

on merit

32 YEARS' DISTINGUISHED SERVICE

One advancement after another — covering more than three decades — has built up Allen's capacity for this emergency. Plant equipment and product-improvement have "worked their way up" to the top.

Training *started in 1910* has qualified this organization to maintain manufacturing standards under war pressure. Quality has not been demoted in the all-out production-drive.

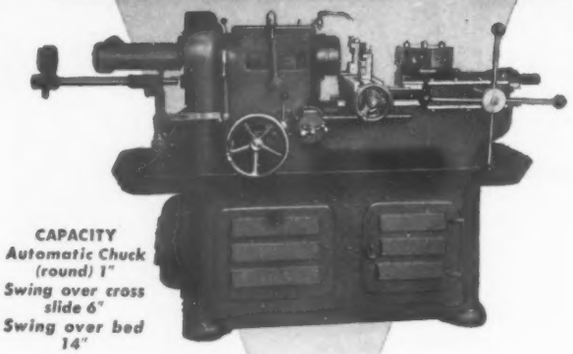
On their RECORD in the hollow screw field, "Allens" have been promoted to First-in-Demand. Their rank is recognized as the earned reward for Distinguished Service.

Your local Allen Distributor will secure for you the largest shipments compatible with your priorities and our intensified production-effort.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.

for ECONOMY—for HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



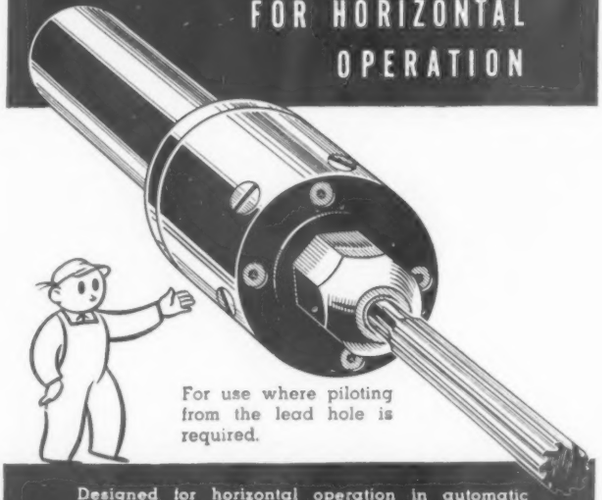
CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

UNIVERSAL FLOATING CHUCKS FOR HORIZONTAL OPERATION



For use where piloting from the lead hole is required.

Designed for horizontal operation in automatic screw machines and turret lathes, Universal Floating Chucks are ideal for drilling, counterboring and reaming. Adjustable spring pressure compensates for tool weight thus preventing scored holes. Write for complete facts and prices.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH · MICHIGAN

Grip a Bending V-Belt

You'll See *How* the CONCAVE SIDE

Saves Belts-Saves Rubber-Saves Power!

Bend *any* V-belt and you can feel it change shape! The top is under tension and grows narrower. The bottom is under pressure—therefore it widens. These two conflicting stresses force a straight-sided V-belt to *bulge* in the sheave groove. (See figure 1 on the right.) This bulging causes uneven wear on the sides of the belt—*shorter life!*

Now look at figure 2. There you see what happens if the V-belt is built with the patented Concave side. The stresses of bending merely straighten the Concave side—making it exactly fit the sheave groove. This means uniform wear and, therefore, *longer life*—a saving in belts, a saving in the Nation's rubber supply. Again, the full side of the belt *uniformly* grips the pulley—carries heavier loads without slipping—another saving of belts and a saving in power too!

What Happens When a V-Belt Bends

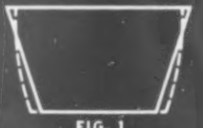


FIG. 1

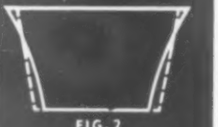


FIG. 2

Only belts built by Gates are built with the Concave side, a Gates patent.

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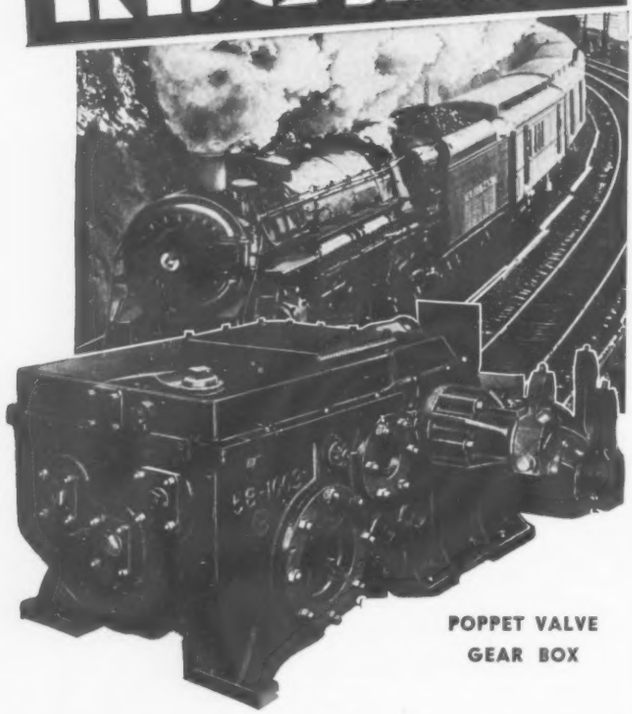
200,000 MILES *and not a bearing failure for* RBC CYCLOPS BEARINGS



POPPET VALVE GEAR BOX

RBC CYCLOPS

Bearings are used in the Franklin System of Steam Distribution, developed and manufactured by the Franklin Railway Supply Co., Inc., which increases "train load speed" capacity up to 44%.

RBC CYCLOPS Bearings are put to a gruelling test in such an application and even after 200,000 miles they show no signs of bearing wear.

The many and varied uses of RBC Roller Bearings prove their ability to do the job. Consult RBC engineers on your job.

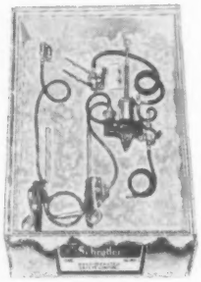
Send for Catalog with Complete Engineering Data

ROLLER BEARING COMPANY *of* AMERICA
TRENTON . . . NEW JERSEY

GET *EVEN MORE* EFFICIENCY

War needs demand that every last ounce of efficiency be wrung from industrial machinery. And you can get greater efficiency from presses, drop hammers and similar clutch-operated equipment by using Schrader Air-Powered Machine Controls.

Schrader Controls reduce the operation of this machinery to a mere touch of the finger tips. Work quality and output go up, as operator fatigue goes down. Safety is easily obtained without cumbersome rigging and without "tying up" the worker. Both hands must be used on the operating levers simultaneously. Plants throughout the country are using Schrader Controls with results that quickly repay their low cost.



COMPLETE ASSEMBLIES . . . YOU JUST INSTALL

Schrader Machine Controls are supplied assembled with all valves, brackets, connections and fittings, ready for quick installation. Your own mechanic or millwright can easily make the installation.

Schrader
REG. U.S. PAT. OFF.
AIR VALVES, GUNS, FITTINGS AND MACHINE CONTROLS

Complete information available through your regular supply house or direct from Schrader. Have you Catalog No. 10?

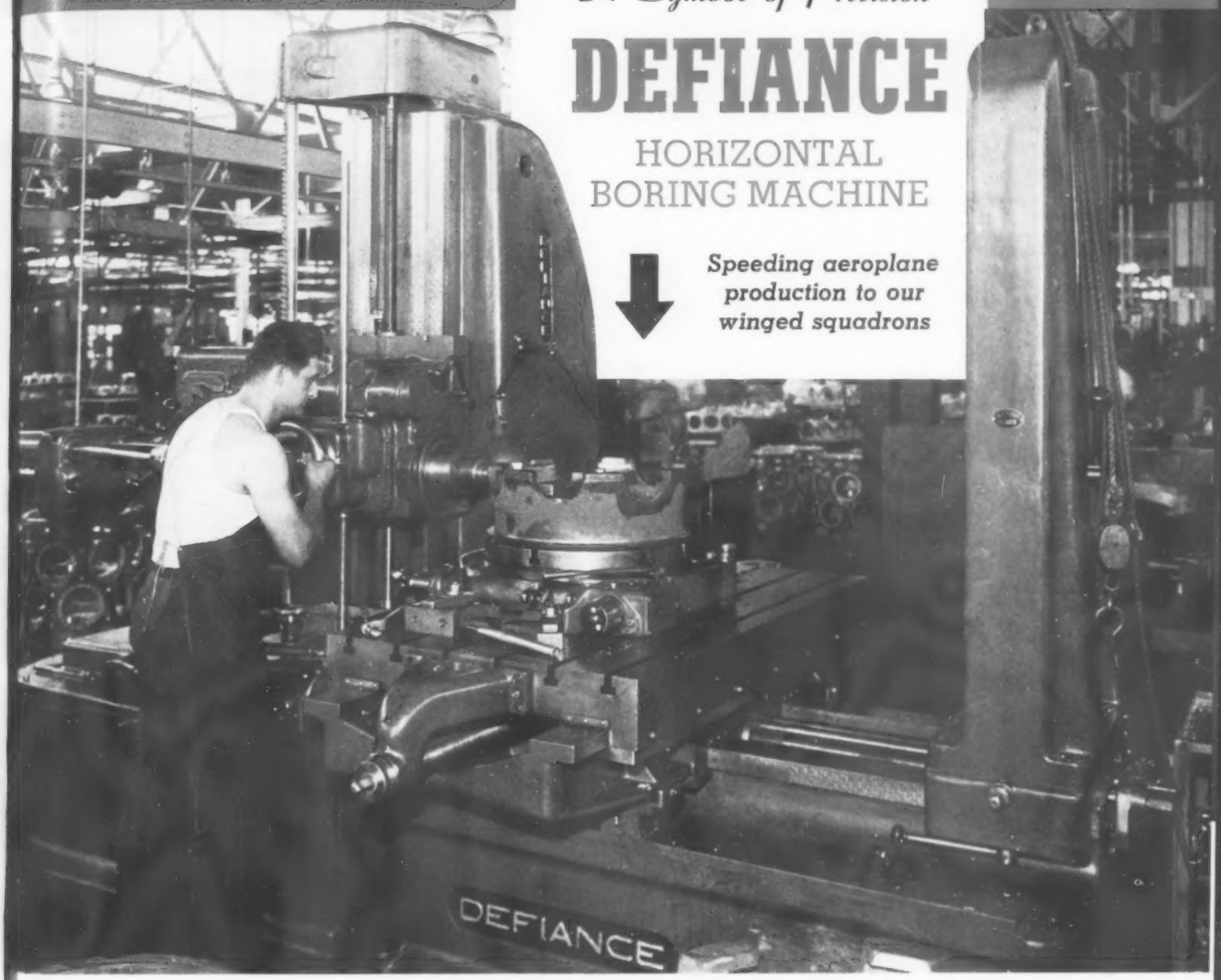
A. SCHRADER'S SON BROOKLYN, N. Y.
Division of Scovill Manufacturing Company, Incorporated

A Symbol of Precision

DEFIANCE

HORIZONTAL BORING MACHINE

Speeding aeroplane production to our winged squadrons



The vast needs of this war both afield and at home have caused manufacturers of planes—tanks—and equipment to raise their production sights to meet urgent requirements.

They want production and want it fast. But they also want accuracy to tolerances previously believed impossible—and they're getting this production and this accuracy from DEFIANCE Horizontal Boring Mills.

Here is a DEFIANCE Horizontal Boring, Milling, Drilling and Tapping Machine in the plant of a prominent eastern airplane builder—doing its share to put more planes on more fronts—quickly. The main spindle of this machine has speeds from 12 to 1000 r.p.m.

All DEFIANCE Boring Machines are thoroughly inspected and checked before shipment and a copy of the check sheet is shipped with the machine. Just a small detail but indicative of the care and skill built into every DEFIANCE Boring Machine.

For complete details write for bulletin.

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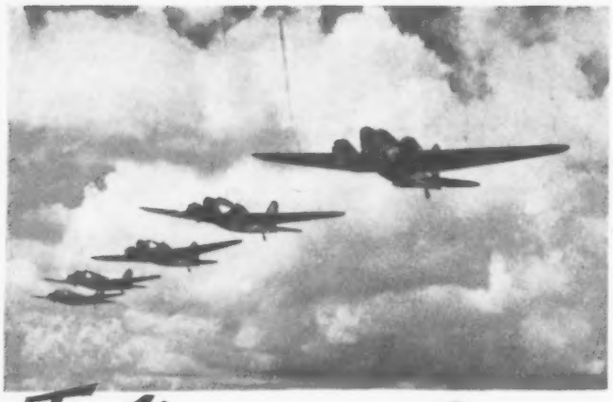
DEFIANCE, OHIO

Makers of Precision Machinery since 1850



"The Yanks are Coming"—

---MORE AND FASTER!

THE job of converting American industry moves swiftly. Yank fighting equipment is moving to every Allied battle front — much more and much faster! To make sure of that, industry is using P&H Zip-Lifts — the time-and-labor-saving hoists that speed the lifting and moving of materials from raw state to finished products — at the mere push of a button. In shops, assembly lines, loading zones and warehouses — they are saving time and energy — making manpower go farther.

HONEST DELIVERY DATES. Our biggest job is to make enough Zip-Lifts to go around. While direct war production needs must be served first, you can always depend on P&H's delivery promises.

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

P&H ZIP-LIFT

HARNISCHFEGER CORP. MILWAUKEE, WIS.

CAPACITIES:
250, 500, 1,000, 2,000 POUNDS

• Full magnetic push-button control — preformed-non-spinning hoist cables—3-way interchangeable mountings—and safety limit switch are just a few of, the *important* features that make P&H Zip-Lifts the top value among low priced electric hoists.

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Low first cost. Low power consumption. Negligible maintenance. In many ways, Tuthill Model C general purpose pumps save you money while serving you dependably. The Model C is a positive displacement, internal-gear, rotary pump—built in 8 sizes from 1 to 200 g.p.m. at pressures up to 100 p.s.i., on non-corrosive liquids. Simple, compact and durable. Operates in either direction of rotation with equal efficiency. Available for direct drive or belt drive. Stripped models and V-belt units also available.

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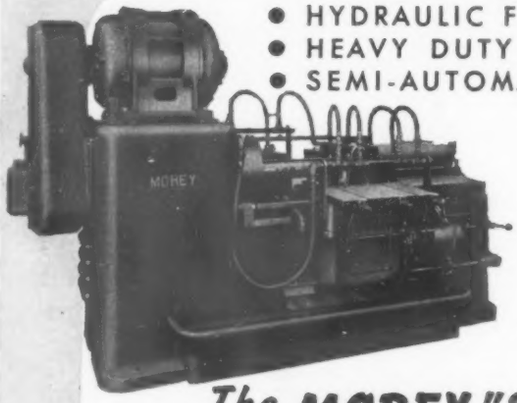

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Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

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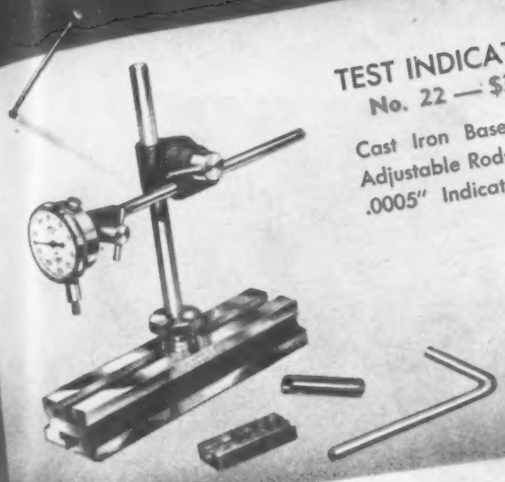
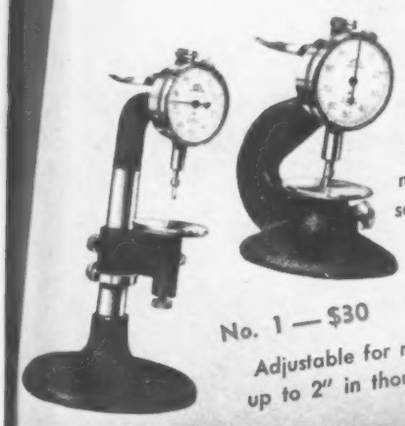


TEST INDICATOR
No. 22 — $30

Cast Iron Base and Adjustable Rods, with .0005" Indicator.

COMPARATORS



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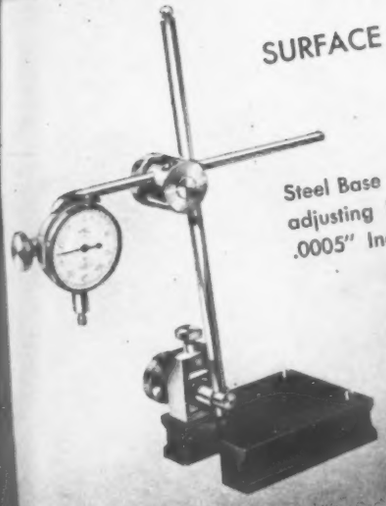

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COMPARATOR

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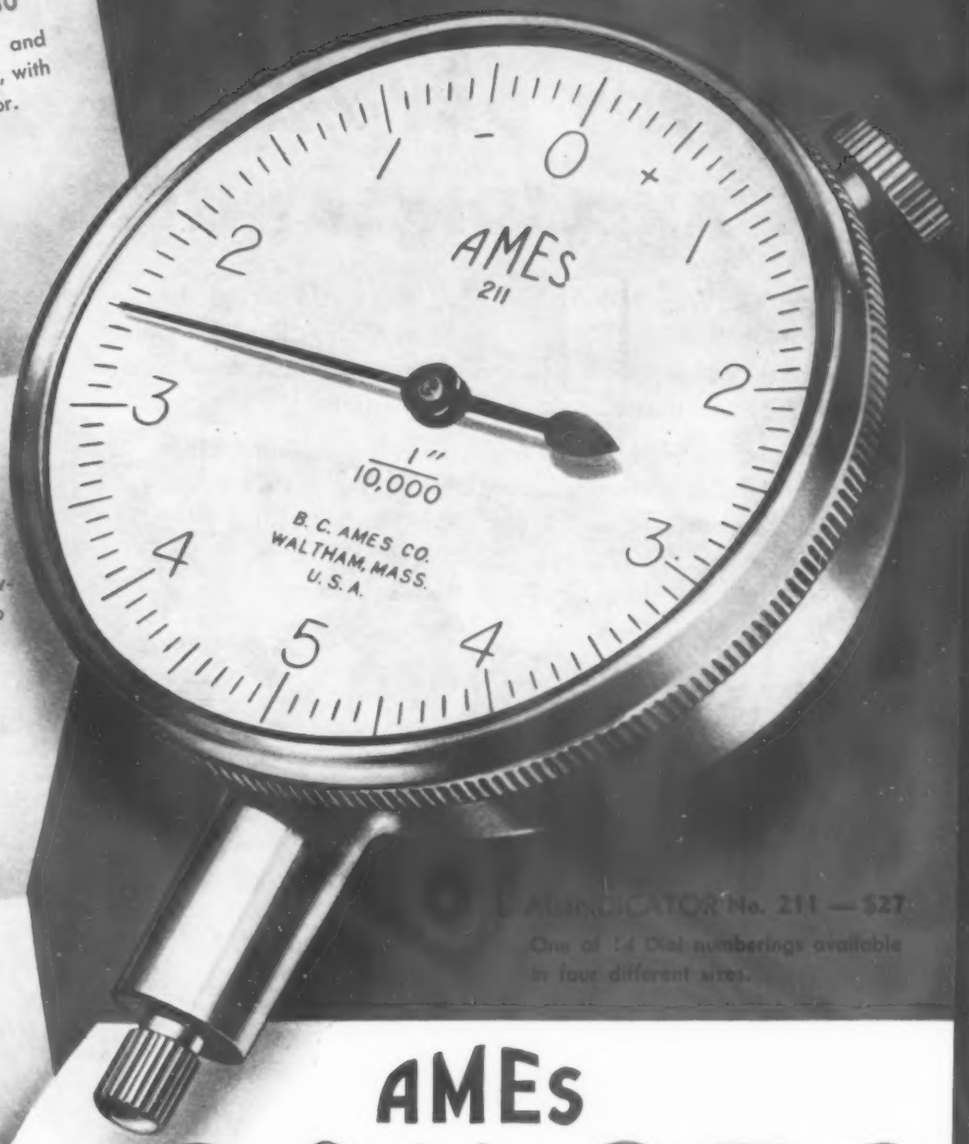

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One of 14 Dial numberings available in four different sizes.

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The many models shown in the new Ames catalog represent the best in design, materials and workmanship that this famous maker has offered during 47 years of experience. They are the most accurate, sensitive and durable instruments of their kind, yet this higher quality costs you no more. Just a few of the more popular numbers are shown here . . . why not send for complete catalog today?

B. C. AMES CO.,
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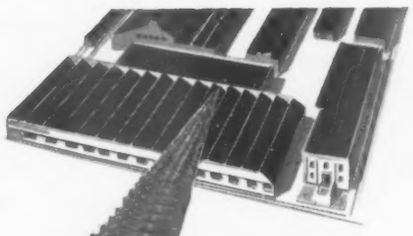
Branch Offices: 423 New Center Bldg., Detroit — 420 Lexington Ave., New York

EVERY DAY *more* AXELSON LATHES...



Every day from the Axelson plant flows a steady stream of Axelson Heavy Duty Lathes. They are destined for war production plants all over the country whose job it is to build *more and more* materials that are vital to our country's victory program.

Since before World War I Axelson has been building lathes of unexcelled performance. During this time Axelson *has never* rationed the quality of materials and workmanship that are combined in producing a lathe recognized for precision, speed and economy. From guns to caissons, airplanes to motors, let an Axelson Lathe help you "keep step" with today's production demands.

It will pay you to investigate Axelson Lathes. They are performing multiple duties in war production plants throughout the vital metal working areas of the nation. Send NOW for illustrated literature. No obligation!

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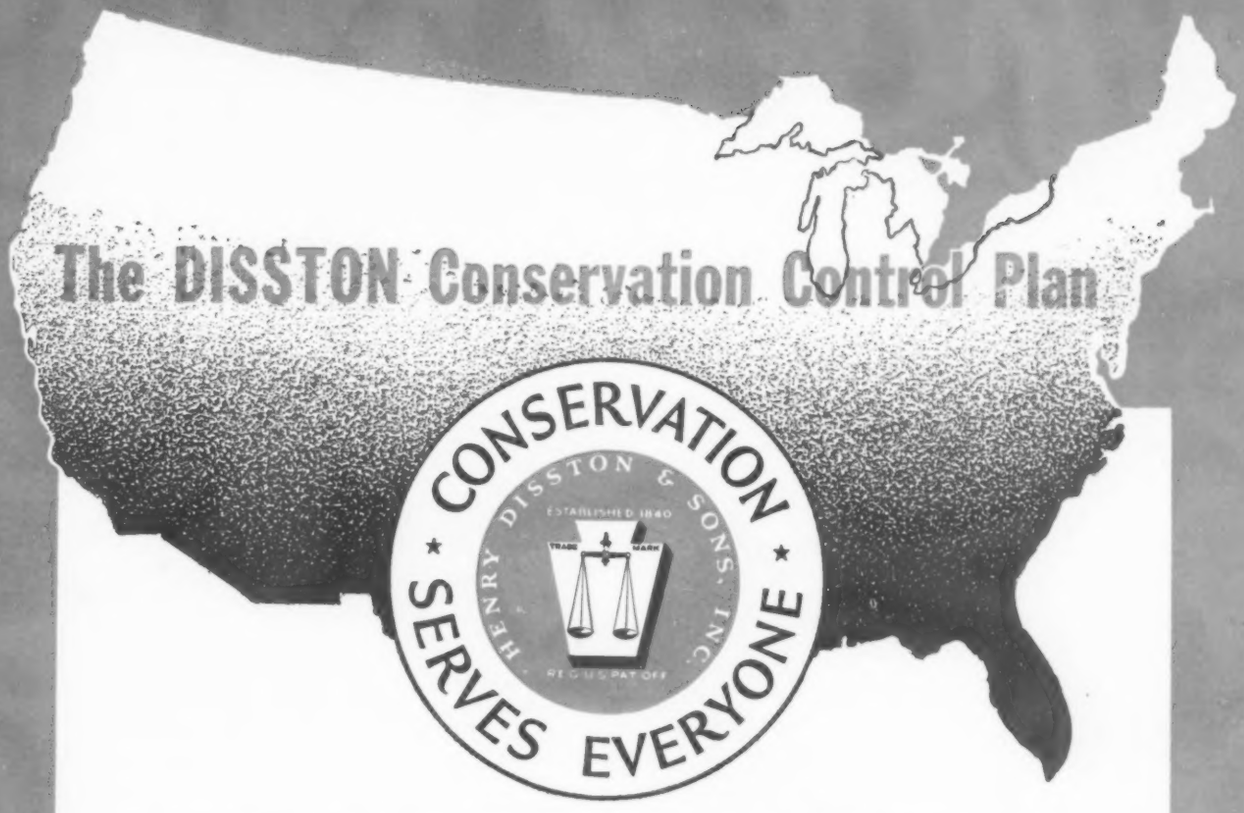
AMERICAN INDUSTRY from coast to coast WELCOMES



The Disston Conservation Control Plan has proved a nationwide success in helping industry save tools, time and materials in the Battle of Production.

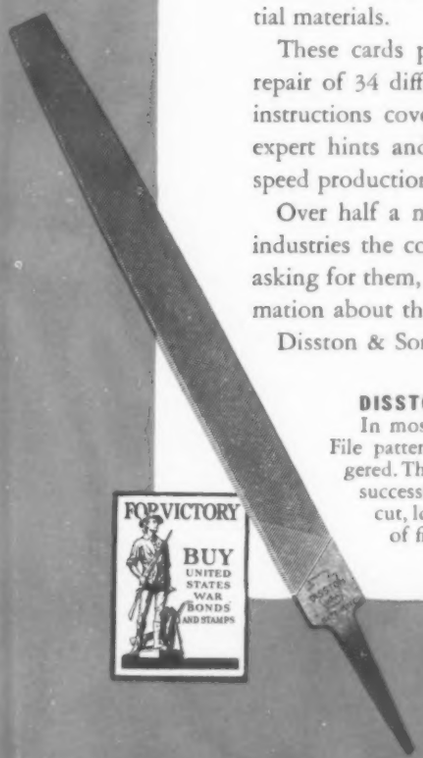
Disston Conservation Control Cards are serving everywhere in the front line of wartime effort—aiding supervision, training workmen, reducing waste, conserving essential materials.

These cards provide practical information on the operation, care, adjustment and repair of 34 different types of cutting tools. They contain concise, plain, to the-point instructions covering the correction of faults, proper tool speeds, tool maintenance, expert hints and helps—all aimed to lengthen tool life, improve workmanship and speed production.

Over half a million Disston Conservation Control Cards have been distributed to industries the country over. *You* can get these cards for use in your plant simply by asking for them, whether or not you are a user of Disston products. For complete information about the Disston Conservation Control Plan write today to Henry Disston & Sons, Inc., 920 Tacony, Philadelphia, Pa., U. S. A.

DISSTON BITE-RITE FILES In most double cut Bite-Rite File patterns the teeth are staggered. This produces a file which successfully combines speed of cut, long life and smoothness of filed surface.

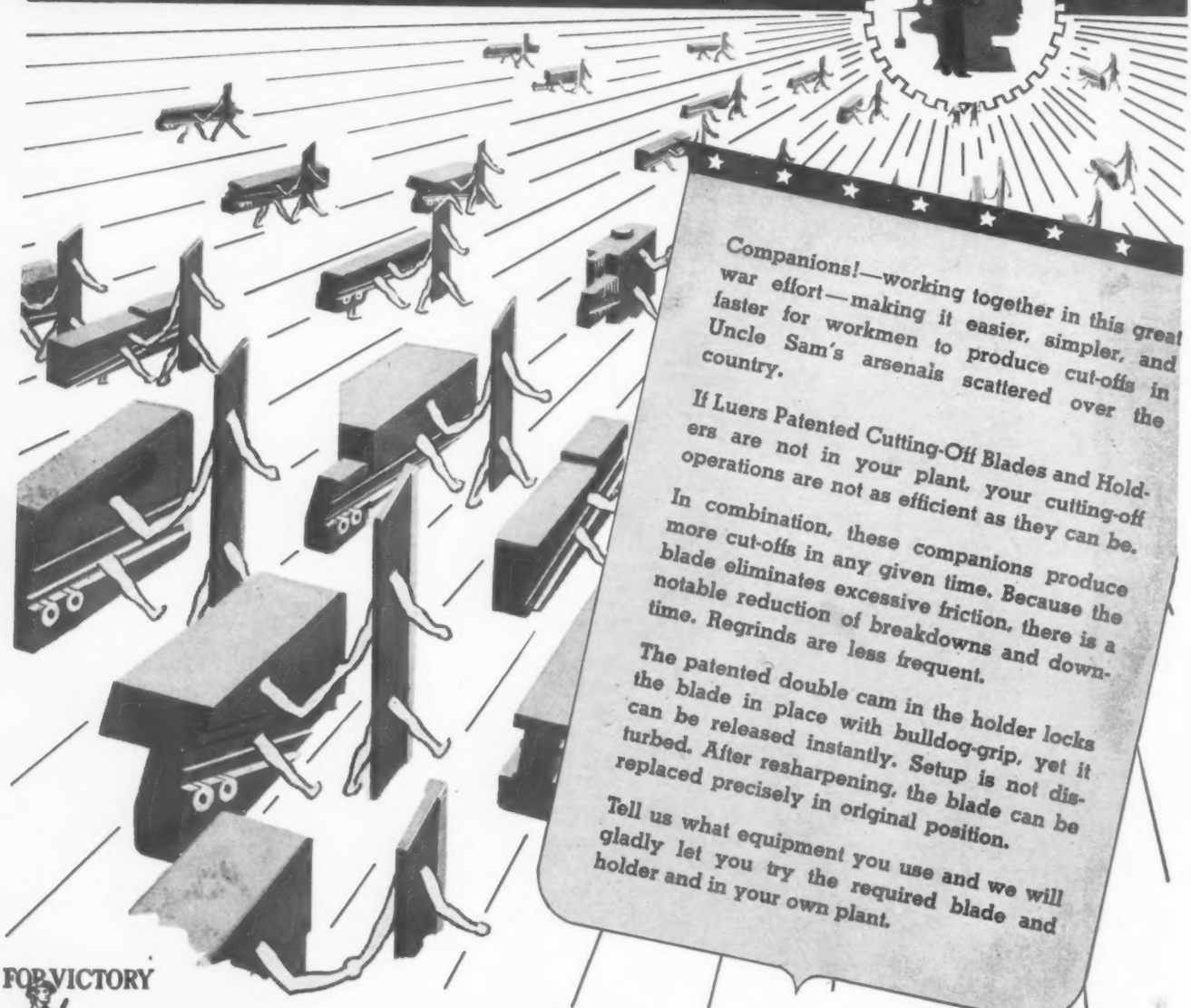
THIS BOOKLET contains reproductions of the Disston Conservation Control Cards, an order blank and full information on the Plan. Send for it today!



LUERS PATENTED CUTTING-OFF

BLADES AND HOLDERS

HAND IN HAND TO VICTORY



Companions!—working together in this great war effort—making it easier, simpler, and faster for workmen to produce cut-offs in Uncle Sam's arsenals scattered over the country.

If Luers Patented Cutting-Off Blades and Holders are not in your plant, your cutting-off operations are not as efficient as they can be.

In combination, these companions produce more cut-offs in any given time. Because the blade eliminates excessive friction, there is a notable reduction of breakdowns and down-time. Regrinds are less frequent.

The patented double cam in the holder locks the blade in place with bulldog-grip, yet it can be released instantly. Setup is not disturbed. After resharpening, the blade can be replaced precisely in original position.

Tell us what equipment you use and we will gladly let you try the required blade and holder and in your own plant.

FOR VICTORY

BUY UNITED STATES WAR BONDS AND STAMPS

Produced under license issued by John Milton Luers Patents, Inc.

EMPIRE Tool Co.

8778 GRINNELL AVENUE
Detroit, Michigan

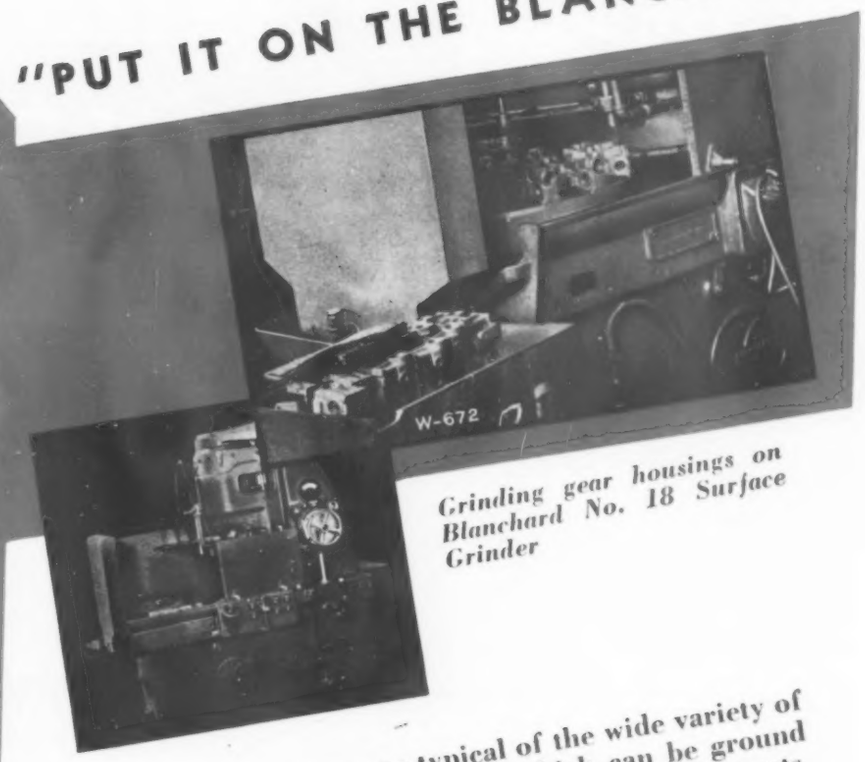
BLANCHARD

"PUT IT ON THE BLANCHARD"

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- **Adaptability**
- **Fixture Saving**
- ★ **Operation Saving**
- **Material Saving**
- **Fine Finish**
- ★ **Flatness**
- ★ **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*



Grinding gear housings on Blanchard No. 18 Surface Grinder

THESE gear housings are typical of the wide variety of small cast iron and steel parts which can be ground better on a Blanchard No. 18 Surface Grinder. The parts require a smooth surface for an oil-tight joint.

1/16″ of stock is removed from one side of these cast iron housings to limits of ±.0002″. 50 pieces are produced per hour.

By Blanchard Grinding, assembly costs can be reduced, hand fitting and scraping eliminated. Other advantages on such pieces are—saving fixture expense, no chipping of corners; chilled or sandy castings cause no difficulty. High production with accuracy is easy the Blanchard way.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

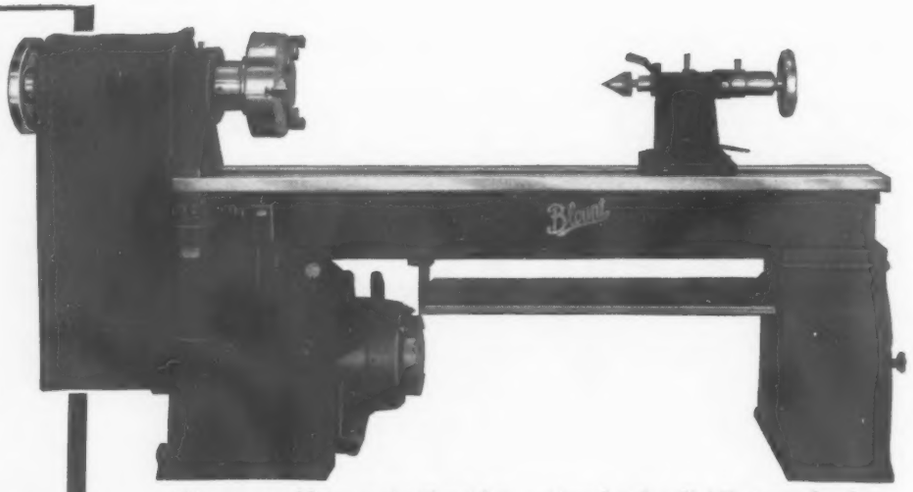
Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

"Blount"

MODEL B-3

Special Application

LATHE



. . . a **NEW DESIGN** *for turning, chucking, polishing and lapping*

Ask for Bulletin D-18 giving detailed information on this machine.

This recent addition to the Blount line, equipped with a ¾ HP. 4 speed reduction motor 515, 850, 1125, 1725 R.P.M., for spindle speeds of 41 to 421 R.P.M. Also can be supplied with a ¾ HP. 4 speed motor headstock 300-450-600 and 900 or 300-600-900 and 1800 R.P.M. for all standard voltages. It has a 20" swing and 8' bed and can be furnished also for a 24" swing. Lathes can also be furnished with hand feed carriage and compound rest.

Convenient control is provided by controller with reversing switch mounted on outside of headstock leg.

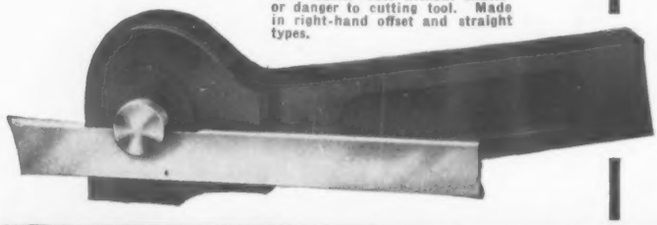
Other details of the Model B-3 include:

Spindle nose 3½" dia. 6v. threads per inch, maximum hole in spindle up to 2½" if desired. Bed 10¾" x 9½" deep with 3" wide shot. Tailstock base 10½" x 10½" with 1¾" dia. spindle with 6" travel and No. 3 Morse taper for center. Lathe Chuck 12" with safety locking screws. Rear hand wheel 11" dia. Standard equipment includes belt and belt guard.

J. G. BLOUNT COMPANY *Everett, Mass., U.S.A.*

Threading Tool Holders—available with five different types of cutters. Any type may be ordered with holder and different types quickly interchanged. Made in straight and right hand offset.

Forming Tool Holders—made in straight and right-hand offset types—faster, smoother machining, free from cutter marks assured. Cutter cannot turn under heavy loads. Positively no side sway.



Cutting-Off Tool Holders—speed up cutting-off operations because spring feature permits faster feeds and heavier cuts without chatter or danger to cutting tool. Made in right-hand offset and straight types.

Faster Cutting Speeds and Heavier Cuts with Safety assured by

WILLARD *Spring* **TOOL HOLDERS**

These modern production aids are making valuable contributions toward winning production battles by eliminating chatter, protecting cutters against breakage and minimizing the chances of spoiled work. By making faster speeds and feeds safely possible, WILLARD SPRING TOOL HOLDERS are finding ever-widening acceptance in automotive, aircraft and other war production shops.

IMMEDIATELY AVAILABLE

Investigate today by sending for Descriptive Circular of WILLARD TOOL HOLDERS for FORMING, THREADING and FORMING TOOLS, CUTTING-OFF TOOLS AND THREADING TOOLS. We guarantee prompt deliveries on a wide range of sizes.

Product of AUTO-ORDNANCE CORPORATION

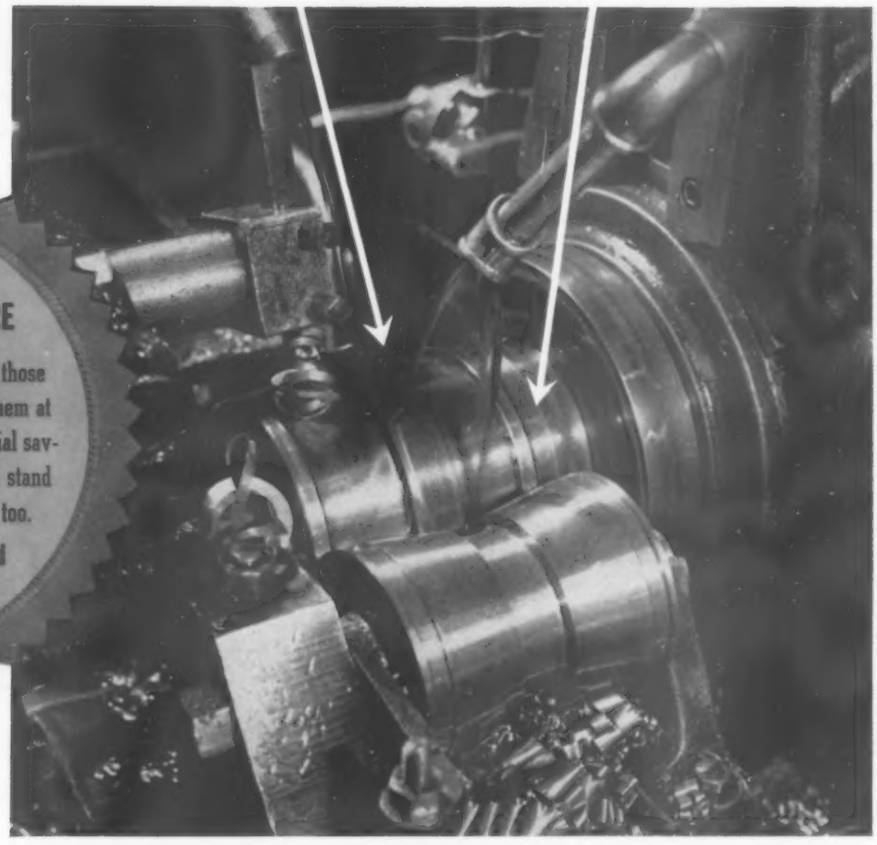
Thompson

1437 Railroad Ave., BRIDGEPORT, CONN.

A tip to Machinists

REDUCE HEAT

FROM 120° TO 70°



KEEP COOL UNDER FIRE

You will have little trouble filling those orders as fast as Uncle Sam fires them at you if you use every time and material saving tip available. This practice will stand you in good stead after the war, too.

Pep Up Production — And You Step Up Victory!

Use tubing in the fabrication of cylindrical parts on your automatic machines; then you'll not have the heavy stock removal problem and the heat that accompanies it. With tubing, heat is reduced in the parts and in the cooling medium too.

A test case showed coolant on a bar job to be 120°F. With tubing, the coolant temperature dropped to 70°F.

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

Steel and Tube Division

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

ALLOY STEELS

. . . look into the smooth, powerful

Metalmaster

Drive . . .

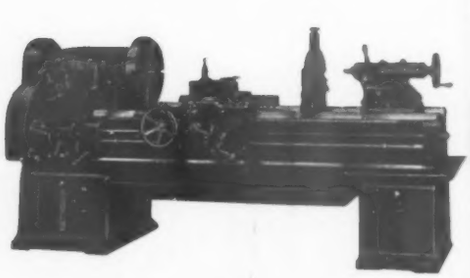
. . . and observe the design and construction which gives the Metalmaster its smooth, quiet, efficient power. Multiple "V" belts deliver power to the head . . . a constant speed standard NEMA frame motor delivers power to the speed change gears through a multiple disc clutch. Motor is housed in ventilated leg beneath headstock. Convenient handles operate the clutch . . . jogging with motor running at high speed is possible with these same handles. Clutch and brake are adjustable from the rear of clutch housing.

ELECTRICAL PUSH BUTTON CONTROL . . . conveniently located in the front of the head, activates all starting, stopping and reversing. All connections and mechanisms carrying current are enclosed in separate compartments in headstock and leg. All wiring is in armored conduit . . . no chance for contact with "hot" wires. Push button station and magnetic starter are standard equipment.

GUARDS of heavy sheet steel, with well rounded corners, cover all exposed gears, belts and sheaves. They are easily removable.

The Metalmaster's motor is not included as standard, but motors furnished by the customer will be mounted and connected at the factory without charge.

Write for the new METALMASTER Bulletin M-M-1

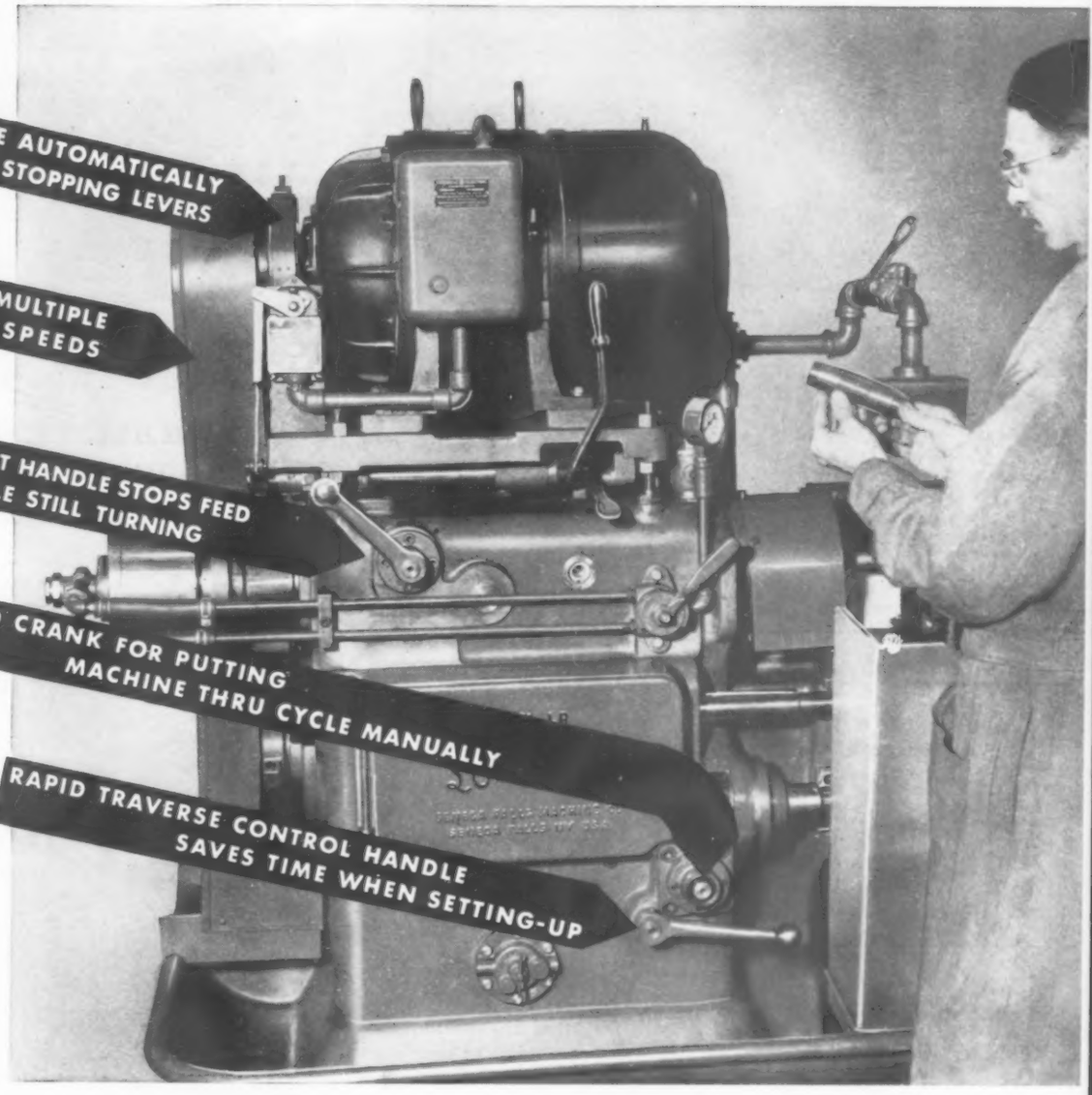


The BRADFORD MACHINE TOOL Co

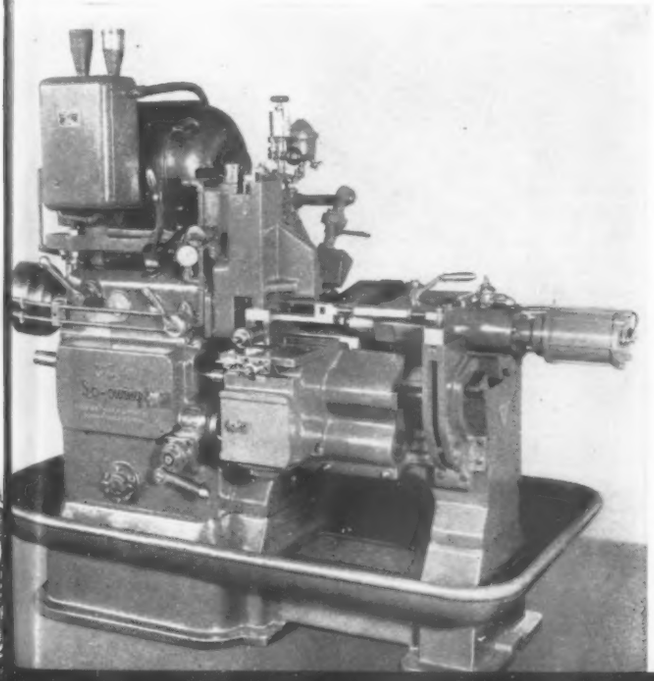
MANUFACTURERS OF METAL WORKING LATHES; CAM FEED DRILLING AND TAPPING EQUIPMENT, HYDRAULIC DRILLING MACHINES . . . IN BUSINESS SINCE 1840

659 EVANS AVE. . . . CINCINNATI, OHIO

Lo-swing FEATURES SAVE TIME AND TOOLS


ECHANICALLY-OPERATED BRAKE AUTOMATICALLY
NTROLLED BY HAND STARTING & STOPPING LEVERS
SMOOTH DRIVE THRU MULTIPLE "V" BELTS FOR HIGH SPEEDS
FEED THROWOUT HANDLE STOPS FEED WITH SPINDLE STILL TURNING
HAND CRANK FOR PUTTING MACHINE THRU CYCLE MANUALLY
RAPID TRAVERSE CONTROL HANDLE SAVES TIME WHEN SETTING-UP

Model LR Lo-swing equipped with Third Slide and tooled for automatic production of trench bombs.



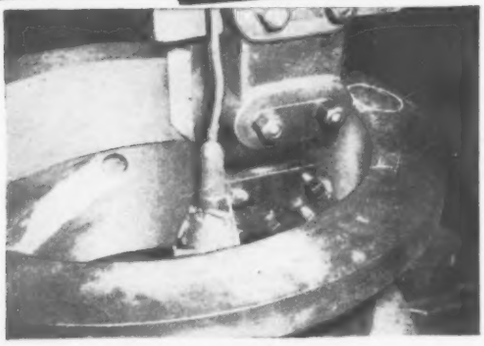
● With the nation at war, *time* and *tools* are two things that must be conserved. Standard Lo-swing Lathe design incorporates many features that make such conservation easy even under the pressure of war production. Note the five built-in features listed above. Consider the importance of the *Feed Throw-out Handle*, for example, when cutting with cemented Carbide tools. If one tool breaks, this lever permits the operator to withdraw all tools before stopping spindle rotation, thus avoiding breakage of the other costly Carbide tools.

Lo-swing efficiency is helping to speed America's war production.

SENECA FALLS MACHINE COMPANY · SENECA FALLS, N. Y.

Lo-swing LATHES

KENNAMETAL* makes TOUGH Jobs EASY



STYLE 11 TOOL

Machines Stellite Valve Seating Strips after ALL OTHER Tools Fail

Here is an excellent example of the versatility and efficiency of KENNAMETAL. The operation involved an interrupted cut in machining large valves and seats having stellite facing, and great accuracy was necessary so that the surfaces, when placed together inside the valve, would be leak-proof.

The job was so difficult for ordinary tools that the manufacturer seriously considered giving it up altogether. KENNAMETAL, however, machined these pieces at 30 ft./min. on both the lathe and boring mill, with feed of .012" to .015" per rev. and cut depth of 1/32" to 1/16". An excellent, smooth finish was obtained.

KENNAMETAL is constantly making similarly tough jobs easy, machining steels of hardnesses up to 550 Brinell at economical high speeds and feeds, taking jump cuts with no tool breakage. Find out what this superior carbide material can do for you . . . write for complete details.

HOW TO TAKE CARE OF KENNAMETAL

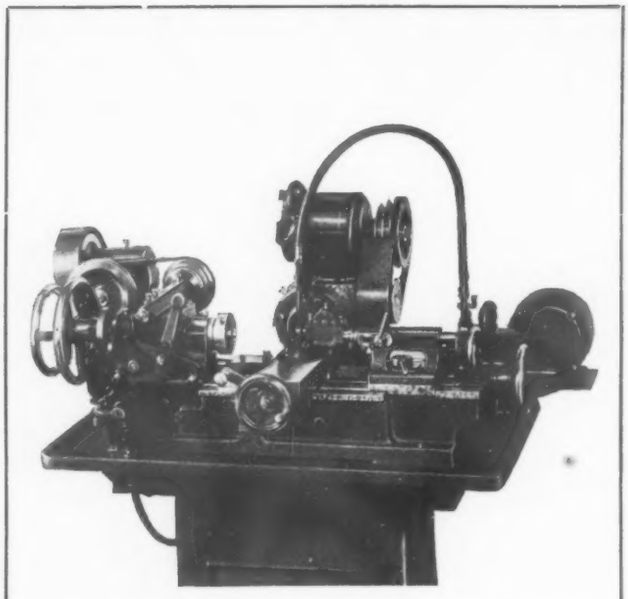
Run at Proper Speed

KENNAMETAL tools operate more efficiently at speeds at least double those of high speed steel tools on similar work. Don't run KENNAMETAL too slow.

*Invented and Manufactured in U. S. A.

KENNAMETAL THE All American CARBIDE

McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PENNA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
(Exclusive of Canada and Great Britain)



WALTHAM THREAD MILLER
WITH 3 MOTOR DRIVE

A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

WALTHAM MACHINE WORKS
HIGH STREET WALTHAM, MASS.

Accurate, High-Speed
MOREY VERTICAL SHAPERS

8" STROKE
12" STROKE
14" STROKE

SELF-CONTAINED MOTOR DRIVE

power rapid transverse feeds in all directions

Timken Tapered Roller Bearings for Main Spindle—all others anti-friction.

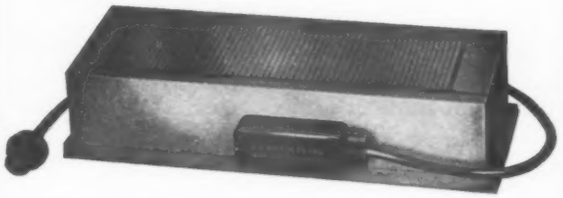
Built to highest accuracy standards the MOREY VERTICAL SHAPER is simple for tool-room manufacturing. Power feeds and power rapid transverse feeds in all directions are instantly available in all operating positions.

Ask for Circular 726

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.

Walker Rotary Magnetic chuck with Concentric Gap—Style D—Face Plate — Walker Rotary Chucks are made in sizes from 4" to 72" diameter with Face Plate construction adapted to the work to be held.

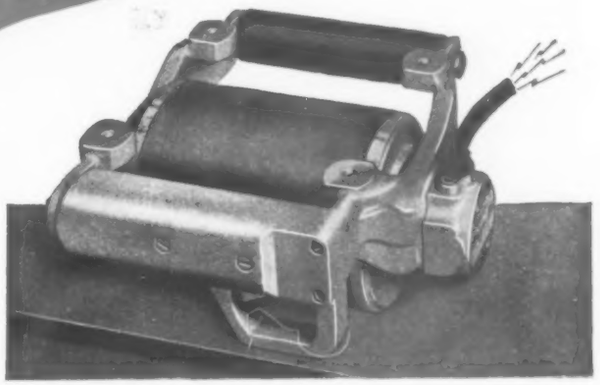
STEP UP WAR PRODUCTION by saving set-up time with WALKER MAGNETIC CHUCKS *



Walker No. 617 Bar Pole Face Rectangular Magnetic Chuck, for holding small thin work. Sizes range from 6"x10" to 12"x60".

Walker Universal Swiveling Magnetic Chuck sizes 4"x10", 4"x20" and 4"x30" — can be arranged with Vernier Reading.

Walker No. 618 Rectangular Magnetic Chuck—available in sizes from 4"x8" to 30"x96".



WALKER DEMAGNETIZERS

These units are available from Walker in standard D.C. and A.C. types for 110 or 220 V service. They provide a fast and convenient means of removing residual magnetism from a wide variety of parts. Send for Circular K7 giving detailed information.

•

Because of their ability to hold work securely under heavy cuts, Walker Magnetic Chucks fit into the demand for high production of war materials. Then, too, these dependable units contribute to more and better work in less time.

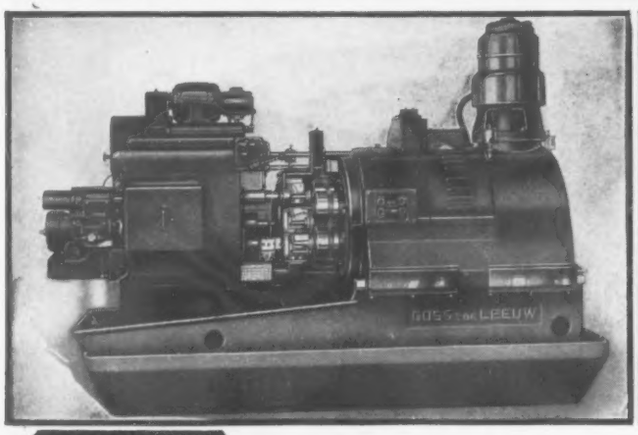
Of proved design and utmost dependability, Walker Magnetic Chucks in Rectangular and Rotary Types help speed up grinding, milling, planing and turning operations. Standard units are available for practically any chucking need. A complete range of sizes makes it possible to select exactly the right Walker for your problem. Magnetic chucks for special requirements can be furnished in reasonably short time.

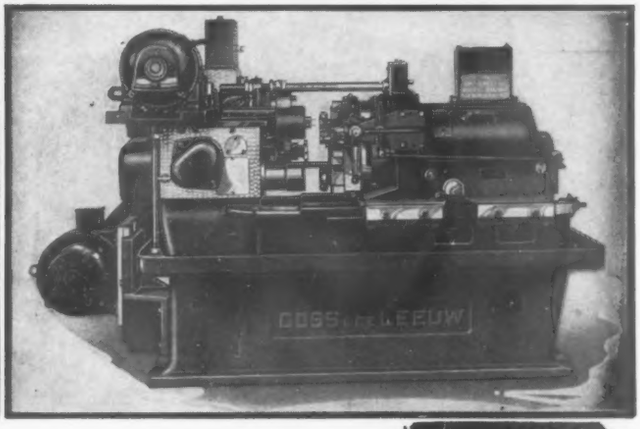
Come to Walker for magnetic chucks and you'll save time and speed up war production.

Write for catalog No. W4 giving complete information

O. S. WALKER CO., Inc.
Worcester, Mass., U.S.A.

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

Features include:

Lead Screw Threading on both types—Pre-loaded Anti Friction Spindle Bearings—Hardened Ways—Oversize Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

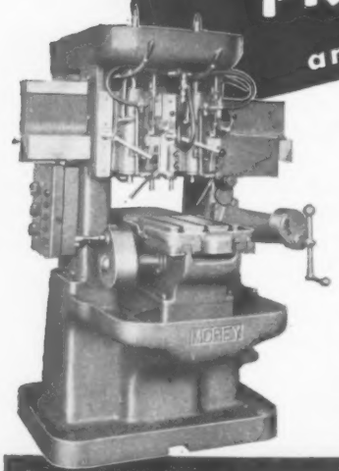
Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

Preloaded Precision Bearings for Spindles

MOREY 12M HIGH-SPEED VERTICAL PROFILER and MILLER

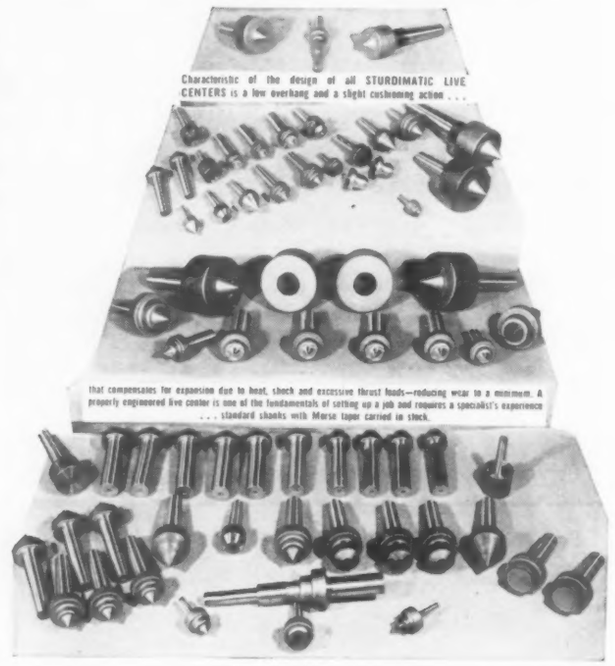


Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.


Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . .
that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

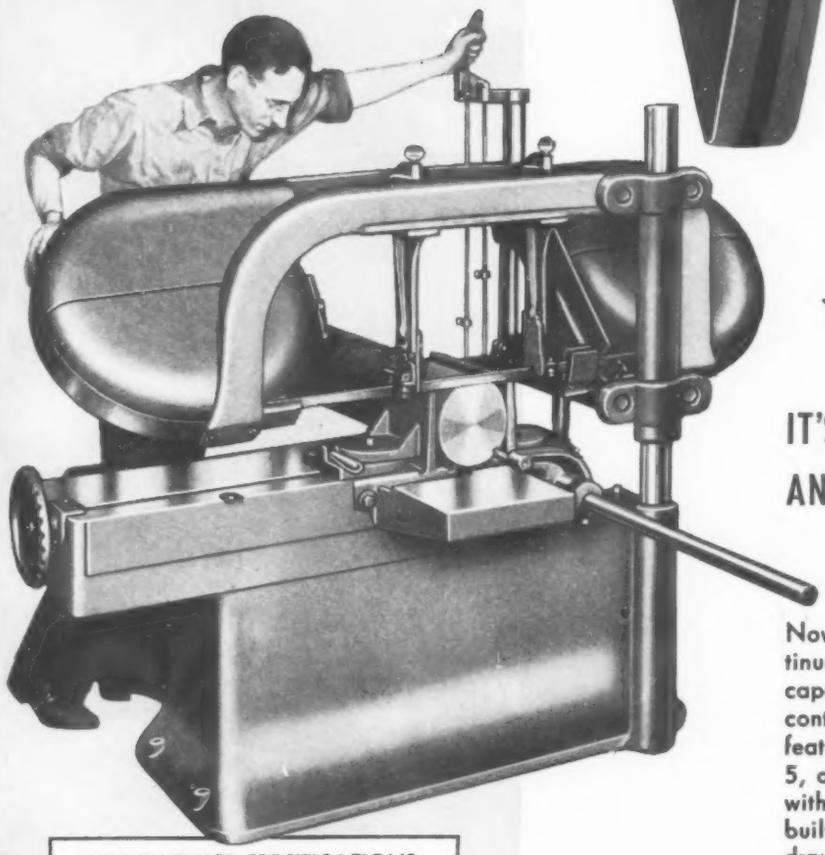
Send us your specifications and blueprints—We will see that your job is set up with the right LIVE CENTER—prompt deliveries on high priorities.

STURDIMATIC TOOL COMPANY

5214 THIRD AVE. DETROIT, MICH.

The *New* WELLS SAW

V-12



IT'S A LARGE CAPACITY, FAST AND ACCURATE MACHINE FOR HEAVY DUTY JOBS

Now you can have the advantages of continuous metal cutting in a heavier, more capable band saw—the new hydraulic-controlled Wells V-12. Many important features proved in the Wells No. 8 and No. 5, are part of this new machine, together with special additional advantages that are built into the V-12. Feed and lift are hydraulically controlled, vise is new and quick action—capacity is 13" diameter rounds and 13" x 16" rectangles . . . the base is solid and . . . But write today for full details on this new Wells machine. You will find it can give you the continuous metal cutting results you like.

A large stock of blades is available at all times

CHECK THESE SPECIFICATIONS of the NEW Wells V-12

Capacity:	
Rectangle	13" x 16"
Round	13" dia.
Speeds: ft. per min.	50, 90, 150
Guides	Adjustable
Feed	Hydraulic-Controlled
Vise	New quick acting type

Wells SAWS
THE SIGN OF SERVICE

WELLS MANUFACTURING CORPORATION • *Three Rivers, Michigan*

Wells

METAL CUTTING BAND SAWS

Blades produced by Clemson Bros., Inc., and affiliated companies are the only molybdenum alloy blades bearing the name "MOLY"*—for STAR "MOLY"* High Speed is the original molybdenum alloy blade, the only genuine "MOLY"*.

Today's STAR "MOLY"*—product of ten years of continuous research and improvement in steel and heat treatment—is still the best, saving time, tungsten and dollars wherever it is used. Be sure you always specify—and get—STAR "MOLY"* High Speed, easily identified by its all-over copper-color metallic finish.

For inexperienced men, buy STAR Unbreakable Special Flexible, the tungsten alloy blade that cuts like an all-hard, yet is so flexible that the most inexperienced shop hand cannot break it in use in a frame.

*T.M. Reg.—for STAR "MOLY" Blades and other "MOLY" Blades of equal quality, made only by affiliated companies.

U.S. PATENT NO. 2
GENUINE MOLY BLADES
ARE MADE ONLY BY THE ORIGINAL MAKERS
STAR MOLY HIGH SPEED

Also helpful

is the illustrated STAR booklet, "Metal Cutting", 20 pages of helpful hints on selection, use and care of hand and power blades, frames and band saws. It's free.

CLEMSON BROS., INC.
MIDDLETOWN, N. Y.

2859

TUNGSTEN CARBIDE TIPPED TOOLS

Price $1.00 Each In Any Size

New Low Prices — Increase Production — Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

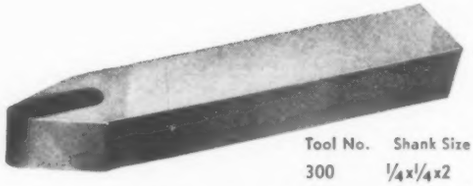
Left Hand-Reverse Image. Right Hand Shown

SERIES 100

Tool No. RH	LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2

SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

WE CARRY SILICON CARBIDE EMERY WHEELS FOR GRINDING TUNGSTEN CARBIDE TOOL BITS

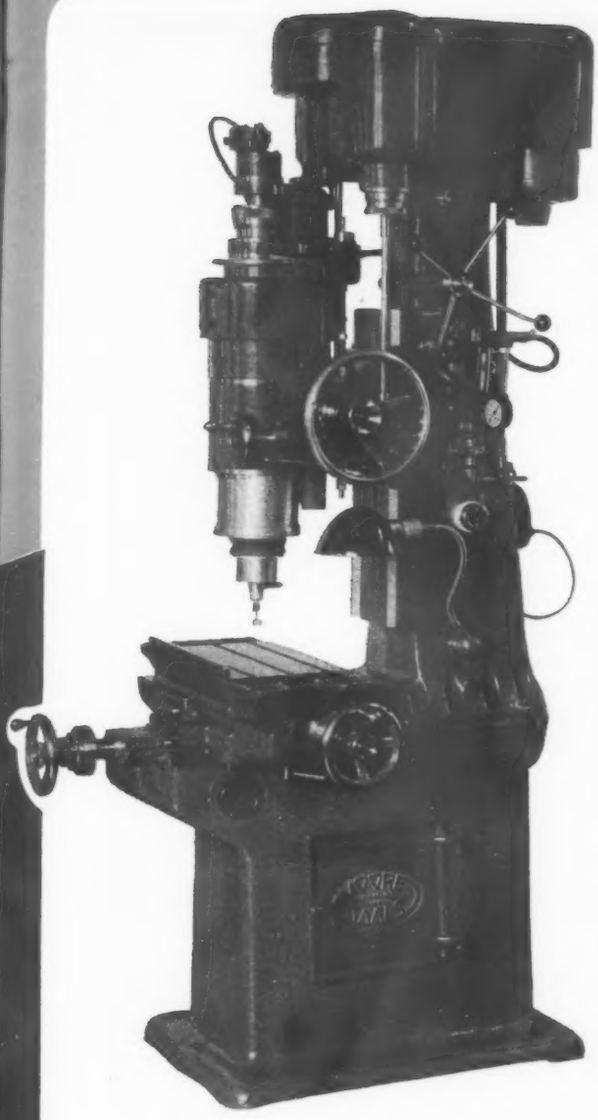
Send for our new 1941 general catalogue

VICTOR MACHINERY EXCHANGE, Inc.
251 CENTER STREET NEW YORK, N. Y.

These

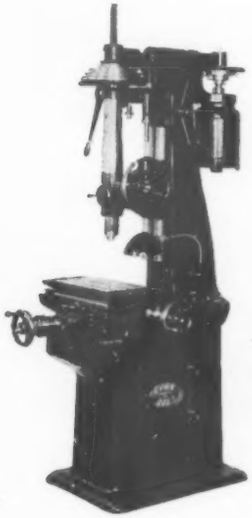
COMPANION MACHINES

are indispensable to speed and accuracy on tool and die work



THE MOORE JIG BORER ACCURATELY SPOTS, DRILLS, REAMS AND BORES

This machine—of advanced design—assures more holes to closer limits of accuracy in less time. It takes its place along with the Moore Jig Grinder as a machine of outstanding importance in today's modern tool room where time and precision are of such paramount importance. It can be depended on to speed up production and minimize mistakes.



Send for illustrated bulletins giving full information on these two machines

The

MOORE JIG GRINDER

relocates and grinds holes . . . with utmost accuracy and speed . . .

This newly developed tool room machine assures big time savings in grinding straight or tapered holes to size and correcting the location in hardened steel parts. It meets the demand for greater accuracy in die and tool work and assures outstanding time savings over hole grinding by make shift methods.

The Moore Jig Grinder is ideally suited to finish-grinding of die holes, as well as hole grinding operations on drill jigs, masterplates and precision gage parts. On progressive die work, using the Moore Jig Grinder, all sections can be screwed and dowelled into place, put on the machine and ground in one setting because the jig grinder can be depended on for accurate location—an advantage which results in hours saved through elimination of slow, laborious checking and measuring on bench and surface plate.

All parts in the spindle unit which are subject to wear are hardened, ground and lapped to assure the maximum in life and precision.

Specifications and Features

Table movement—9¼" to 14¼"

Table to wheel—0" to 8"

Spindle speeds—infinite from 50 to 150 RPM

Feed to spindle—automatic—infinite from .004" to .020" per rev.

Grinding speeds—15,000, 50,000

Grinding capacity—from .030" to 5", cylindrical or tapered

Accuracy of screws—.00005" per inch; .00015" per 10"

Micromatic adjustment of offset—direct to .0001"

Manufactured by

THE MOORE SPECIAL TOOL CO., Inc.

BRIDGEPORT, CONN.

Exclusive Representative

MARBURG BROS., INC., 90 West Street, NEW YORK

Surface Plates Angles and Cubes

These units are precision-built—all made of Meehanite iron recognized for its dense, uniform grain structure and its unusual wear-resisting quality.

This assures a smooth, flawless surface that increases efficiency of your inspection.

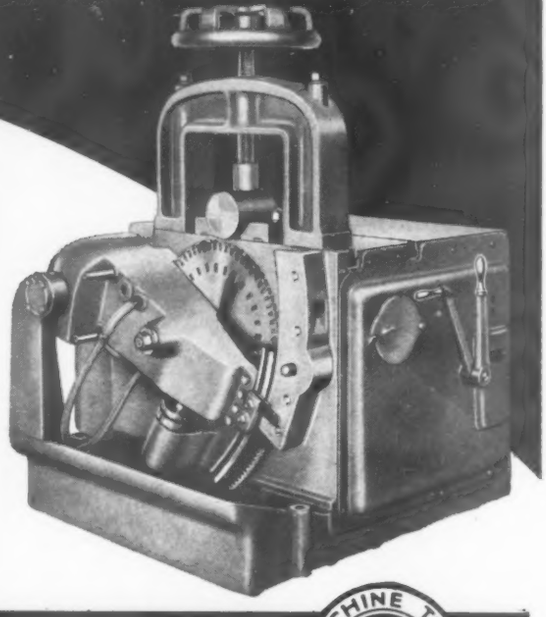
The surface plate has scientifically designed ribs to give absolute rigidity and strength to entire surface.

Send for folder

V

MACHINE PRODUCTS CORP.
6769 McNICHOLS ROAD • DETROIT, MICHIGAN

THIS PORTER-McLEOD CUTTING OFF MACHINE *PAYS FOR ITSELF* IN STEPPED-UP PRODUCTION



If your cold metal sawing involves cutting stock from 3 inches up, here's the machine to put such operations on a production basis.

This new Porter-McLeod 8" machine is particularly advantageous on larger sizes of stock. *By supporting the blade close up to the* rim of the blade and *pulling* the blade through the cut, buckling of the saw is prevented and accuracy maintained.

The standard feed of this machine is 3 inches a minute but can be stepped up for cutting brass and non-ferrous metals.

Because of the great leverage exerted on the blade through the Porter-McLeod Pull Method of Drive and the support at the rim of the blade, this machine requires less power and assures a straight cut. Multiple units can be cut at one time on the Porter-McLeod by means of the upper feed of the machine which permits nesting of bars.

Explore the great time and money-saving possibilities offered by this modern production cutting off machine. Investigate *NOW* by sending for complete details.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

Another Tribute To The Super Smooth Finish and Accuracy of SUNNEN PRECISION HONING

To insure interchangeability of parts, we use Sunnen honing on our HYDRO-POWER Valves and Control Bodies.

— The Hydraulic Press Manufacturing Co.

● To aid them in living up to their slogan of "It Must Be Right," the Hydraulic Press Manufacturing Company has adopted Sunnen Precision Honing.

Replacing hand reaming, the Sunnen method not only saves time, but, in addition, makes possible close tolerances and a super-smooth finish.

You, Too, Can Profit by These Advantages—

If you are reaming or grinding internal cylindrical surfaces from .185" to 2.400" in diameter, this practical, inexpensive, accurate machine will help you speed up production, cut costs, and improve accuracy.

The Sunnen Precision Honing Machine does not require skilled labor—workers in "teens" can handle jobs in "tenths." Can be set up and work located in less than a minute. Accuracy within .0001" guaranteed. Corrects errors of out-of-roundness or taper caused by previous operations. Relieves big internal grinders for other jobs. Doesn't need fixtures—work is held in hand by operator. Provides simple, low-cost method for duplicating sizes.

Put Sunnen Precision Honing to work in your plant.

The Sunnen Precision Honing Machine puts the finishing touch on internal bores of valve and control bodies, assuring a fine finish with holes that are straight and true.

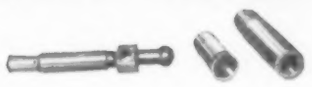
SUNNEN PRODUCTS COMPANY
7941 Manchester Avenue St. Louis, Missouri
Canadian Factory: Chatham, Ontario

SUNNEN

Send for FREE BULLETIN

—giving complete information. Or, if you prefer, a Sunnen Sales Engineer will demonstrate this equipment in your plant on your job.

Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

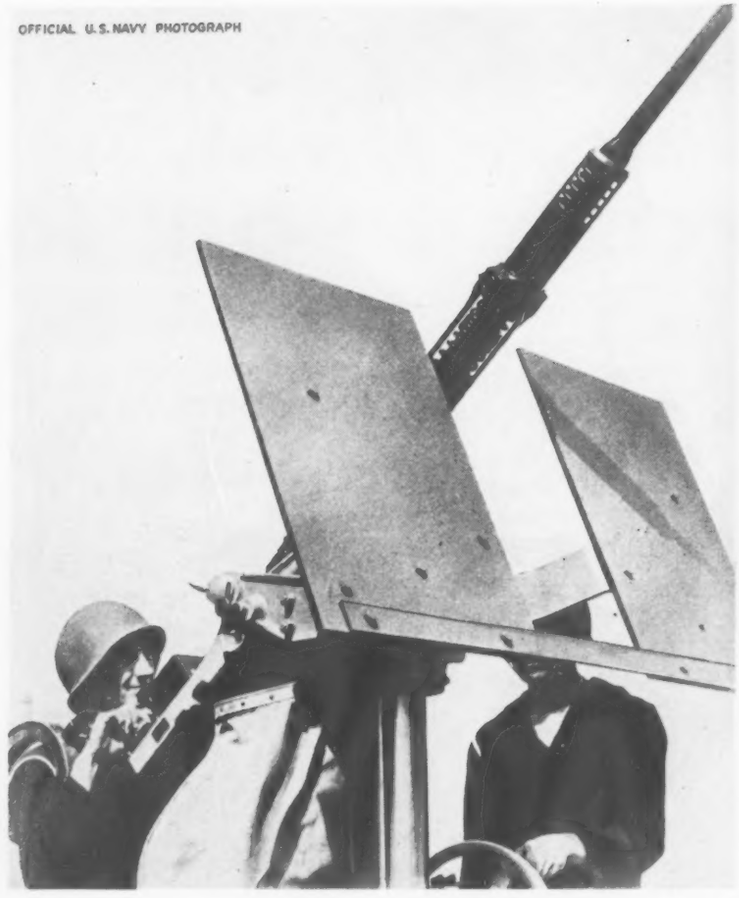


Airplane Engine Parts accurately honed to a super-smooth finish.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Aircraft Valve Tappet Roller. 4-Micro finish.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 in."


OFFICIAL U.S. NAVY PHOTOGRAPH

GRAND RAPIDS

THE SURFACE GRINDER FOR FASTER OUTPUT IS THE MACHINE FOR MAKING GUNS . . . . .

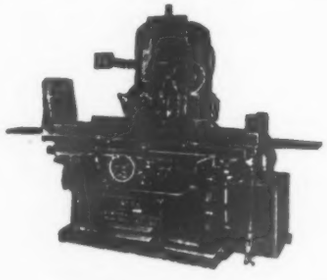
Grand Rapids Grinders are doing their bit in the manufacture of the famous Oerlikon gun, by grinding trigger housings to close limits at a high production rate.

Grand Rapids machines earned their stripes more than 20 years ago through their ability to produce work to the highest degrees of accuracy in long hard service. Their ability to speed the output of commercial products and their versatility are again being demonstrated in precision armament manufacture. And what Grand Rapids Grinders have done in peace time work they will do again because they are universal production speeders ready for any job that comes within the scope of their broad utility.

With sizes and types available for a wide range of requirements, Grand Rapids Grinders can solve both tool room and production problems.

Our engineers are ready to apply their experience to your needs.

GRAND RAPIDS HIGH SPEED NO. 55 HYDRAULIC FEED SURFACE GRINDER



This modern, precision machine, for tool room or production, has a table working surface of 12"x36". Automatic table travel is 38"; transverse travel is 13½".

Furnished with infinitely variable table speeds, vernier vertical wheel adjustment and rigid, one-piece column and base as well as with hydraulic feed, this Grand Rapids machine can be depended on for the maximum in convenience of handling and smoothness in operations.

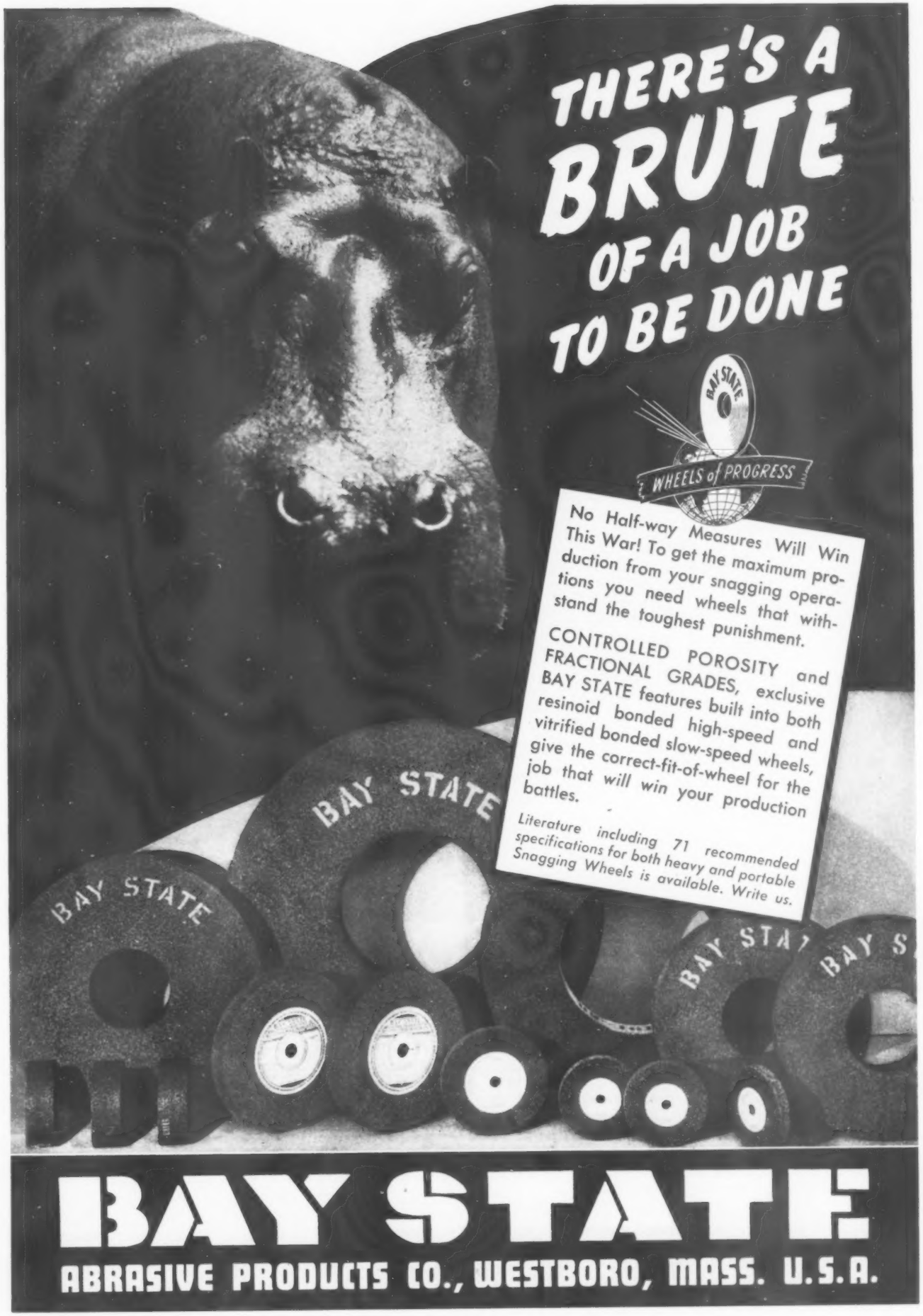
For detailed information ask for Bulletin GL100.

GRAND RAPIDS TOOL AND CUTTER GRINDERS NOS. 4 AND 5

These Grand Rapids machines can be depended on to assure perfect tool sharpening and thereby contribute to faster production and longer tool life. Operation from front or rear facilitates handling.

Ability to perform internal, surface or tool grinding quickly, accurately and conveniently makes these Grand Rapids machines ideal for sharpening such tools as gear cutters, formed cutters, angle cutters, face mills, end mills, side mills, spiral and plain milling cutters, thread chasing tools, reamers, hobs, etc. Ask for Bulletin 3-1-41 giving full details.

GALLMEYER & LIVINGSTON CO.
330 STRAIGHT AVE.
GRAND RAPIDS, MICH.


THERE'S A
BRUTE
OF A JOB
TO BE DONE
BAY STATE
WHEELS of PROGRESS
No Half-way Measures Will Win This War! To get the maximum production from your snagging operations you need wheels that withstand the toughest punishment.
CONTROLLED POROSITY and FRACTIONAL GRADES, exclusive BAY STATE features built into both resinoid bonded high-speed and vitrified bonded slow-speed wheels, give the correct-fit-of-wheel for the job that will win your production battles.
Literature including 71 recommended specifications for both heavy and portable Snagging Wheels is available. Write us.
BAY STATE
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BAY STATE
ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

To plant supts. This is one of a series of ads addressed primarily to new grinder hands. If you would like additional copies without our signature, for your bulletin board, tell us how many you need.

HOW TO GET BETTER AND LONGER SERVICE FROM GRINDING WHEELS

● Speeding production is only part of a grinder hand's wartime job. Basic materials must be conserved at the same time. With grinding playing so important a part in production, these simple rules may help you do both parts of your job better.

1 MAKE SURE THE GRINDING WHEEL IS CORRECTLY MOUNTED

To get the best service from grinding wheels, you must start with the right wheel and the correct set-up. Next it is important to make certain the wheel is properly balanced and correctly mounted. This must be done painstakingly to make sure it is in perfect balance and runs true without vibration or wobble. Where operators have difficulty doing this, they should ask their supervisors for instructions on proper balancing, truing and mounting procedure.

2 MAKE SURE THE GRINDING MACHINE IS IN GOOD CONDITION

The right wheel, the correct set-up and proper mounting are still not enough to insure long wheel life if the grinding machine itself is not in good condition. Bearings should be snug, foundations firm and every care taken to keep the machine as free from vibration as possible. The inspections and servicing necessary to maintain a grinding machine in tiptop condition will be paid for many times in longer wheel life, better work and higher production.

THE CARBORUNDUM COMPANY • NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

HYBCO TAP GRINDERS

for Sharpening

CHAMFER • FLUTES • SPIRAL POINTS

★ The HYBCO Tap Grinder is fast and easy to operate—sharpens chamfer on all lands with each rotation of the hand wheel.

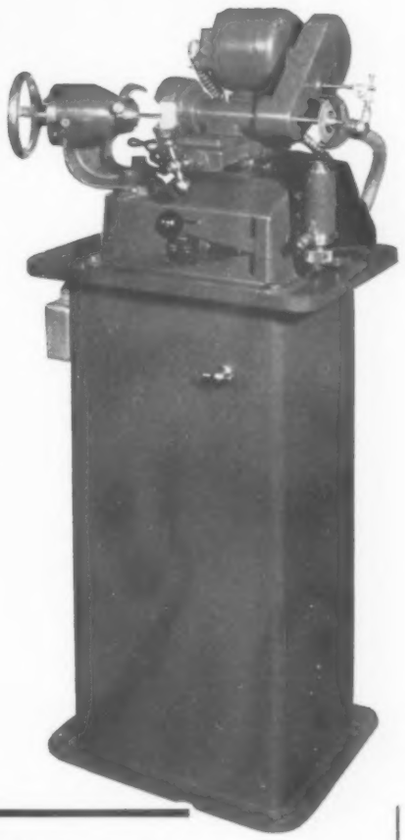
Features a belt driven grinding wheel spindle—any type motor may be furnished, depending upon your requirements.

Built in three types—Bench—Floor Type—Floor Type with built in dust collector.

CAPACITY:

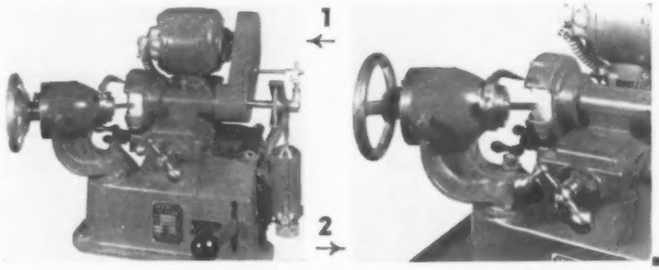
Three sizes of chamfer and flute heads are available — capacities — machine screw to 1½" hand taps. Can be arranged for any number flutes—right or left hand.

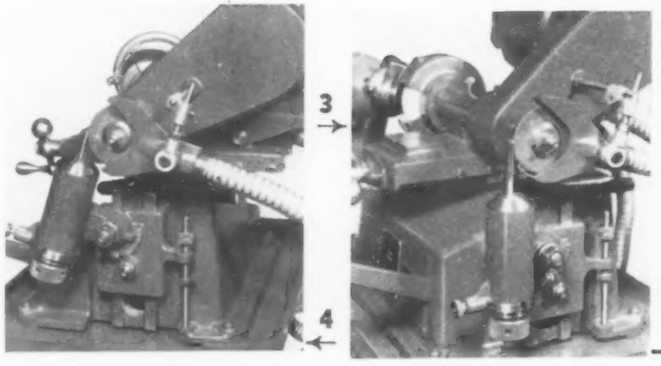
The HYBCO is a complete grinder for sharpening — Chamfer — Flutes and Spiral Points. Representatives in all important cities.



ALL TAPS HELD BY SHANK

Taps can be sharpened after center is destroyed





1. **Bench Type Grinder**
2. **Sharpening Chamfer**
3. **Grinding Flute**
4. **Grinding Spiral Point**

HENRY P. BOGGIS & CO.,

1279 W. 3rd St., Cleveland, Ohio

Please send me your full descriptive Tap Grinder Bulletin.

Name.....

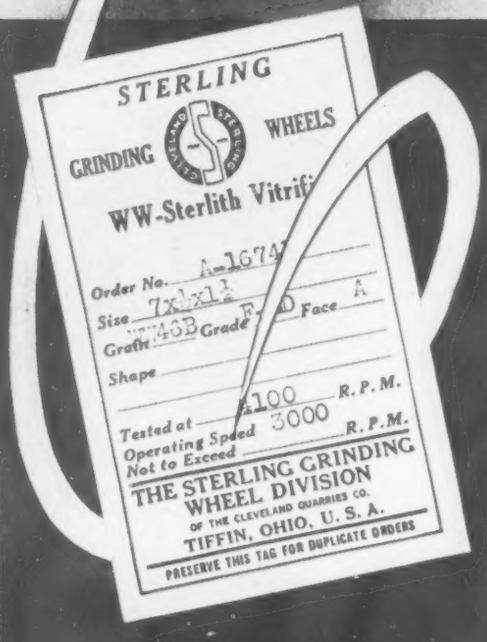
Company.....

Street.....

City..... State.....

A GOOD WARTIME EFFICIENCY RULE!

Keep A File of STERLING Speed Tags for Ease in Reordering



Each tag on every Sterling Grinding Wheel clearly indicates top operating speed . . . provides important data when you wish to reorder, too! For best possible grinding results, read your Sterling tag!

EVERY Sterling Grinding Wheel comes to you with a small tag attached. This tag gives recommended top speed at which the wheel should be operated. It also gives important data on wheel size, grain, grade, face, and shape of the wheel. By keeping a file of these tags, and marking on them the type of material on which the wheel was used, machine shop foremen have a valuable reference when reordering wheels for similar jobs.

Remember, there is a Sterling Grinding Wheel for every operation in your grinding departments. Backed by the experience of our Field and Factory Engineers, these "wheels of industry" will live up to every demand you make on them.

As a result of thousands of calls on all types of industries all over the country, Sterling Engineers are well equipped to solve any of your troublesome grinding problems . . . they will gladly call and help you do better work faster . . . no obligation of course. Ask for this service -- now!

• STERLING ABRASIVES •

THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY

EXTRA HEAVY DUTY MULTI-OPERATION DRILLING AND BORING MACHINE

BAKER

EXTRA HEAVY DUTY MULTI-OPERATION DRILLING AND BORING MACHINE

• Here's an adaptation of standard BAKER Units to multi-roughing operations in the cross bore of airplane propeller hubs. The hubs, which are solid forgings of rough material, demand extreme rigidity and power on the part of the machine. Five operations are performed, with one hub at each machine cycle . . . the six station index table allows one station for chucking. Main drive, and oil gear pump drives, total 90 H.P.

This use of standard BAKER units in special operations demonstrates the flexibility and versatility found in all BAKER machines. When you have a problem in tapping, drilling, boring or facing, let BAKER help you solve it! Write for complete details today!

MACHINES OFFERED TO SUIT BOTH LOW AND HIGH PRODUCTION

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

SINGLE AND MULTIPLE SPINDLE MACHINES FOR

DRILLING • BORING • FACING • TAPPING

MACHINING EYE-OPENER!

New PORTER-CABLE Wet-Dry BELT SURFACER

Does this Facing Job* in

28 SECONDS!

(former production 4 per hour)

*By surfacing this cast steel bearing cap the old way on a lathe, with a cast stud for chucking, production averaged 4⅓ pieces per hour. From the start of the new belt-machining method, these parts were produced free-hand at the rate of 28 seconds each! (Illustration ⅓ size)

MAKE savings in time, money and man-power *yourself* by switching to this new belt machining method! Get outstanding production increases! Take burden off millers, grinders, shapers, lathes and other hard-pressed units!

Porter-Cable machines use abrasive belts having cutting speeds to 6000 surface feet per minute . . . belts with the grits and joints bonded by heat- and moisture-resisting plastic. This wet-belt method eliminates dangers of heating, discoloring, warping and fracturing . . . prevents dust hazards . . . safely handles infiammable materials.

Close-Limit Quantity Production by Unskilled Workers

Simply operated, wet-belt surfacing enables the use of inexperienced operators . . . conserves your skilled men. And the machine itself insures *quantity with quality* . . . you can depend on true, straight-grain surfaces whether flat or curved.

Ideal for TOOLROOM

Many toolroom operations help make this belt surfacer a big-paying machine. It gives accuracy within .0005", plus sizable saving of major machine tool investments.

So call the nearest Porter-Cable representative, without obligation, and arrange demonstration. Send for free new booklet showing many valuable applications of Wet-Dry Belt Surfacing. Write today!

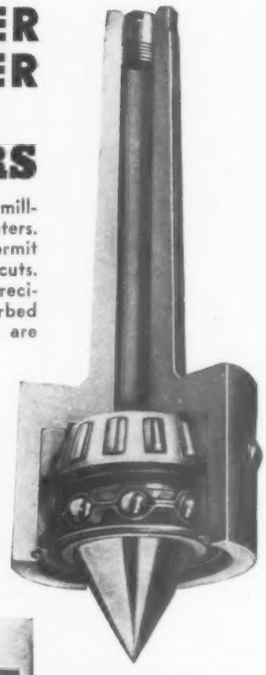
Quick Deliveries Right Now!

PORTER-CABLE MACHINE CO.

1725-9 N. Salina St., Syracuse, N. Y.

TURN HEAVIER LOADS FASTER WITH IDEAL LIVE CENTERS

Get more work, quicker, out of lathes, millers, grinders, etc., with IDEAL Live Centers. They rotate with the work, therefore permit heavier loads—faster speeds—deeper cuts. The radial load is carried by a high precision ball bearing, and thrust load absorbed by a taper roller bearing. All parts are hardened and ground.



TRIPLE DUTY

Three interchangeable Center Pieces (illustrated below) for all kinds of centered and uncentered work. Save set-up time.

OTHER PRODUCTION SPEEDERS

FREE CATALOG Describes these and other IDEAL Production Speeders. Write for your Copy.

IDEAL COMMUTATOR DRESSER COMPANY

1057 Park Avenue — Sycamore, Illinois

SALES OFFICES IN ALL PRINCIPAL CITIES

In Canada: Irving Smith, Ltd. Montreal, Quebec

A "Blow by Blow" report on BASA*
Special features at no extra cost
Made in five sizes
Heads conveniently adjustable
Faces replaceable in a few seconds
Interchangeable faces of rawhide, copper and babbitt
Finest quality Java water buffalo rawhide faces
Carried by leading mill supply houses. Also EMPIRE* Rawhide Mallets
The old faces slip out.
the new ones slip in
BASA*
REPLACEABLE FACE
HAMMER
GREENE, TWEED & CO.
Bronx Boulevard at 238th Street, New York

THE ABRASIVE No. M3

Surface Grinder with Motorized Spindle

The ABRASIVE M3 Grinder with Motorized Spindle was devised at the request of several customers and combines the advantages of two Abrasive Grinders. Reorders from these customers made it seem wise to add the M3 to our regular line of grinders. The machine itself is the popular No. 3B with full automatic feeds, a fast, accurate, carefully designed machine. The motorized spindle is similar in design and construction to that used so successfully on the No. 1½ hand operated grinder.

The M3 delivers full motor power to the wheel, without vibration, by using a well balanced motor, with the rotor mounted directly on the wheel spindle, eliminating belts, chains, and sprockets. The wheel spindle can be of either the ball or plain bearing type. Longitudinal and transverse feeds are driven by a separate ½ h.p. motor in the base of the machine.

BETTER DELIVERY ON THE M3

Delivery on the M3 Surface Grinder is today months in advance of the 3B due to the fact that this is the first public announcement of this machine.

ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE, RHODE ISLAND, U. S. A.

WRITE OR PHONE NEAREST DEALER

HOME OFFICE
East Providence . . . East Prov. 0549

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Vitrified

Cuts longer between turns

Vitrified Grinding Wheels assure economy in high quantity production fine precision grinding because they cut longer between each wheel truing. Then, too, these long life, strong wheels require less redressing. They can also be depended on to eliminate gumming, glazing and heating.

All these advantages are available regardless of the grinding job, because there is a size, shape and type Vitrified Grinding Wheel for every grinding purpose. The completeness of the Vitrified line makes it possible for any shop to standardize on Vitrified Wheels.

Our engineers will gladly study your grinding operations and point out the savings you can make through the use of Vitrified Wheels.

BORITE—for all kinds and classes of steel grinding.

CARBORITE—for all classes of cast iron, brass, bronze and aluminum grinding.

Also, Sillicate, Shellac and Resinoid Bonded Wheels.

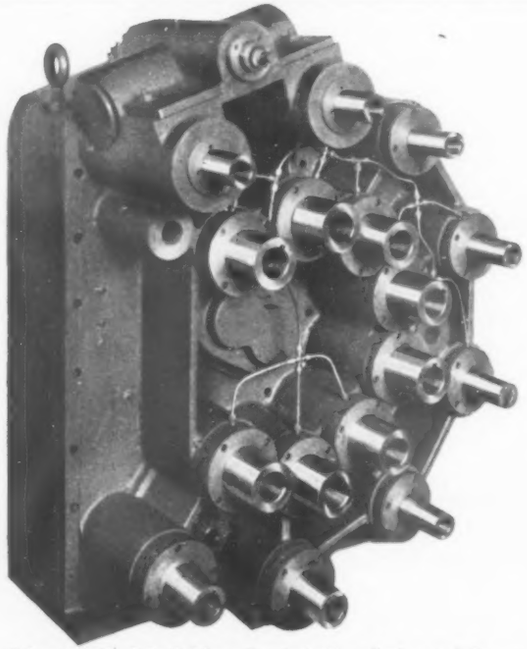
VITRIFIED

VITRIFIED WHEEL COMPANY
WESTFIELD MASS.

Buhr **DRILL HEADS**
SIMILAR TO THIS ONE,

ARE SPEEDING PRODUCTION IN VITAL WAR PLANTS

Here is but one example of the specialized engineering incorporated in BUHR-designed drill heads, now being used in the production of aircraft and armament. Want similar applications, so as to speed your work? Then send us your blueprints . . . . we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.



Sixteen-spindle Buhr Drilling, Counterboring, Facing and Reaming Head, designed for the left-hand head of a 2-way Machine. Vertical adjustment. Two top spindles are accelerated to give three times the feed of the other spindles. Oil pump provides positive lubrication.

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICH.
Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

Hammond NO-DUST GRINDERS*

ADDED 50% VALUABLE FLOOR SPACE TO OUR DEPARTMENT

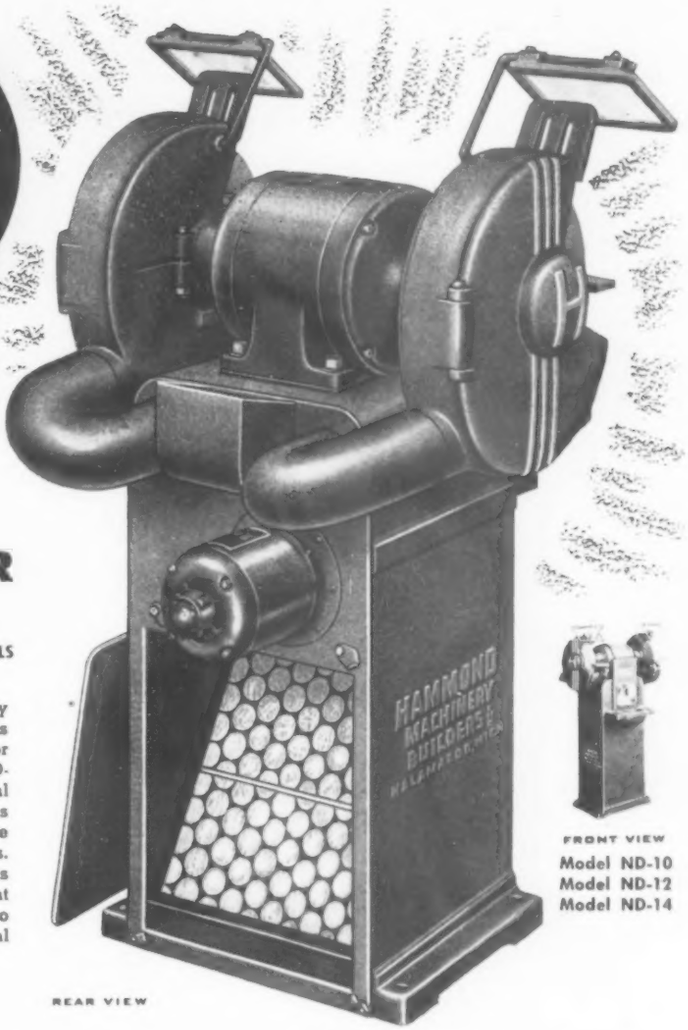
*Completely self-contained Grinder and Dust Collector

3 POPULAR SIZES

FOR 10", 12", 14" WHEELS

Hammond NO-DUST Grinder units, streamlined and functionally designed, require only 6½ sq. ft. of space for 12" or 14" models —less for 10". Average grinder with independent dust collector requires almost 15 sq. ft. of today's valuable floor space. The NO-DUST Grinder is the most compact unit on the market—the practical approach to present needs for conserving space. As a result of this great saving in space the Hammond NO-DUST Grinders may be placed closer to walls, in line back to back, or nearer post supports. The dust collector unit is mounted inside the grinder — only parts extending are: fan motor, connecting pipe, and air exhaust vent guard. No further need to figure out independent connections to permanent dust collector system. Set it up anywhere near electrical outlets and put it to work.

WRITE FOR BULLETIN GP-13



REAR VIEW

FRONT VIEW

Model ND-10
Model ND-12
Model ND-14

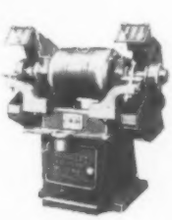
FLOOR TYPE Combination

HAMMOND ABRASIVE BELT SURFACERS Types 400 Dri and Dri-N-Wet, Types 600 Dri and Dri-N-Wet

Model 400 Dri

HAMMOND HEAVY DUTY GRINDERS And Complete Line of other Tool and Snagging Grinders

HAMMOND Model "4" COMBINATION CHIP BREAKER and CARBIDE TOOL GRINDER



Model WX-5

New HAMMOND WET TOOL GRINDER

With 20" Wheel

Model 20-S

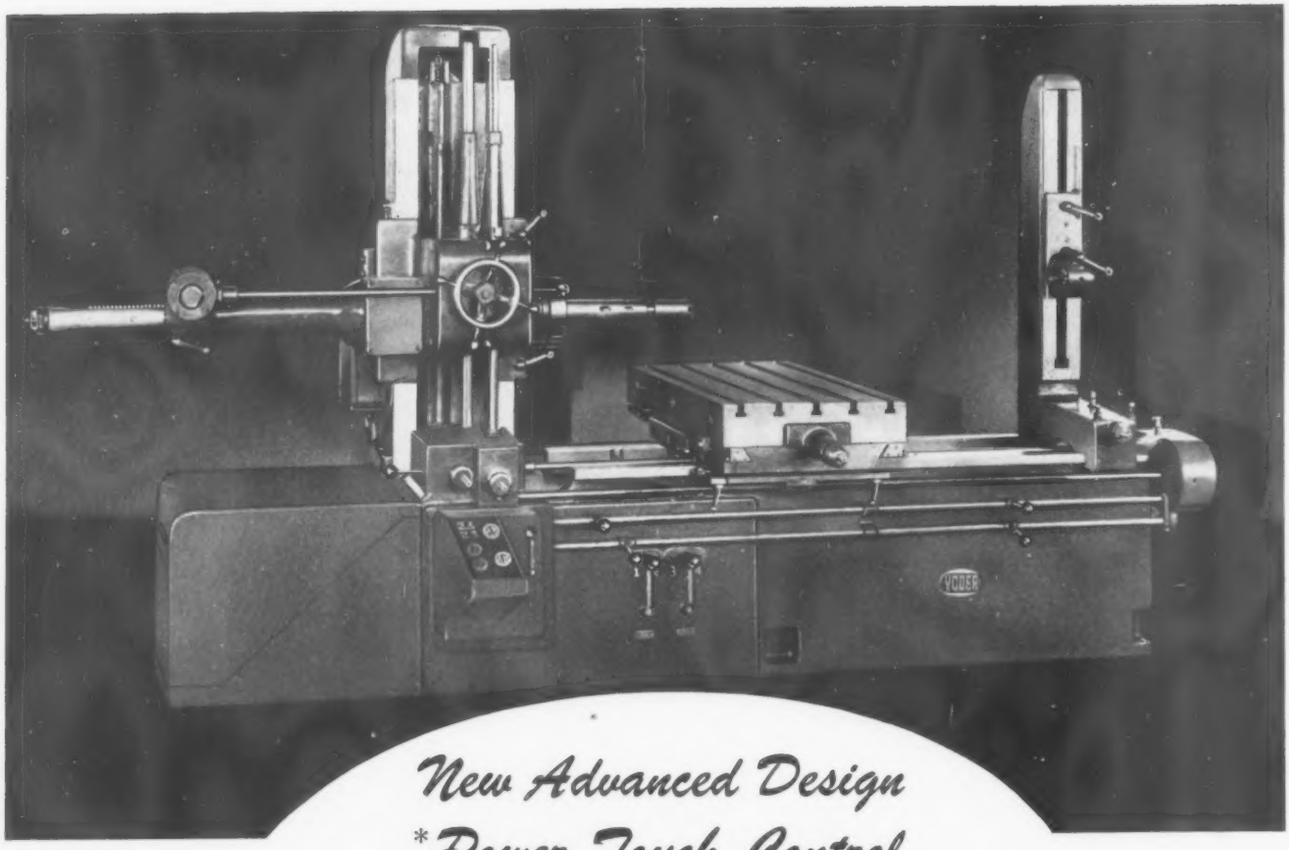
All the latest improvements for grinding larger tools, tungsten carbide and general grinding. Features new, improved Combination Tool Rest and Wheel Dresser. Design permits use of 8" x 8" tilting table for grinding Carbide Tools (optional).

WRITE FOR BULLETIN 101

Hammond Machinery Builders INC.

1618 DOUGLAS AVENUE • KALAMAZOO • MICHIGAN

EASTERN BRANCH 71 WEST 23RD STREET, NEW YORK CITY



New Advanced Design

***Power Touch Control**

Yoder NO. 3A HORIZONTAL BORING MILL

*POWER TOUCH CONTROL completely meets the demand of war production that EVERY MACHINE BE RUN AT THE MOST PRODUCTIVE OF SPEEDS AT ALL TIMES. Every bit of power can be put on tools, up to the last limit of safety. Feeds and speeds of an infinite variety can *flow* at the touch of the control hand. That *power-flow drive*, we call it.

Read all about this feature and many more in the . . . .

NEW YODER No. 3A Horizontal Boring Mill BULLETIN.

ENGINEERING YODER MANUFACTURING

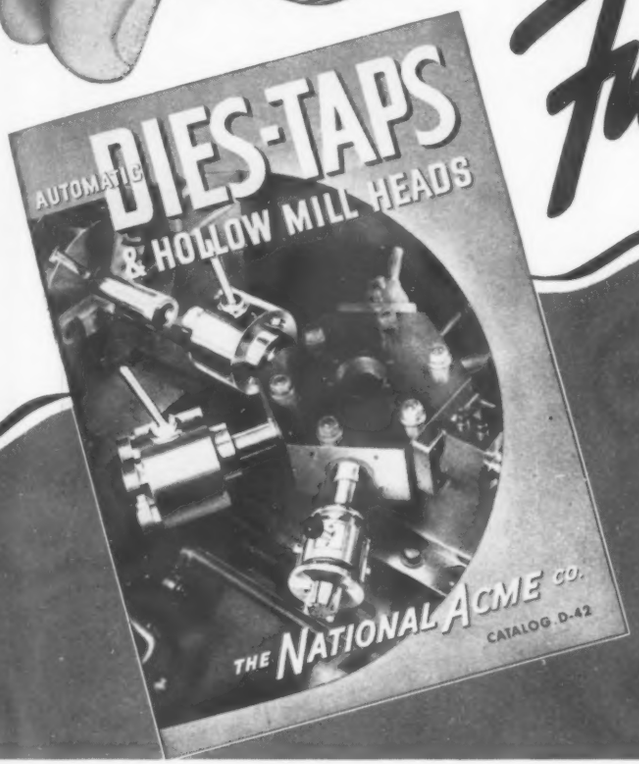
Yours for the writing!

The ENGINEERING YODER MANUFACTURING SALES COMPANY

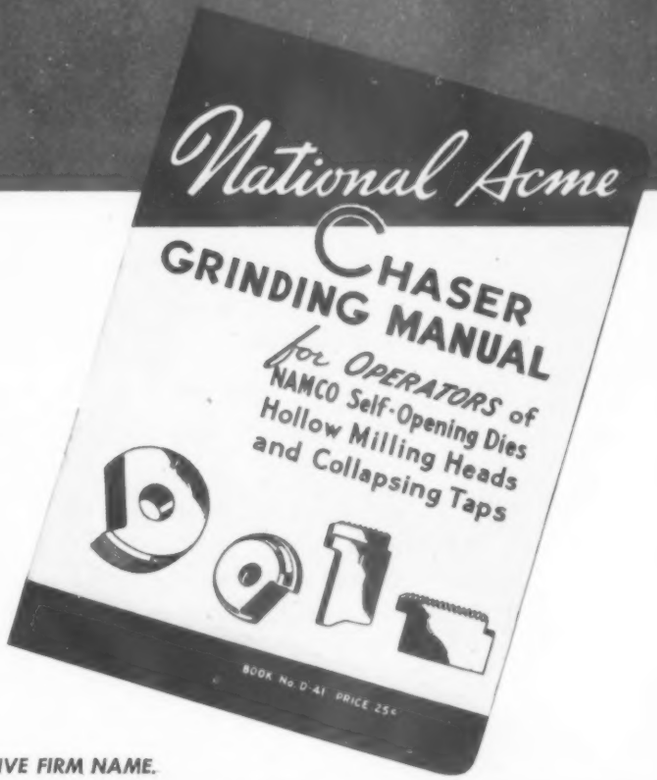
CLEVELAND, OHIO

YOU GET THE IMPROVEMENTS FIRST FROM YODER

Cutting Fussy Threads?



..THEN YOU CAN'T AFFORD TO BE WITHOUT THESE *New Books!*



D-41 — CHASER GRINDING MANUAL for foremen and operators of Namco circular and radial chaser dies and taps — 32 pages with 50 illustrations of practical service hints that insure uniform threads, save time and speed production.

D-42 — DIE AND TAP CATALOG explains "RS", the new universal design of collapsing tap with ground thread radial chasers — a combination that holds accuracy on difficult jobs.

— shows how circular chasers multiply ordinary chaser life twenty to forty times in hundreds of war production shops — and how you can use circular hollow mills in these same tools, with tremendous savings in tool investment and circular cutter life — "double duty" tools.

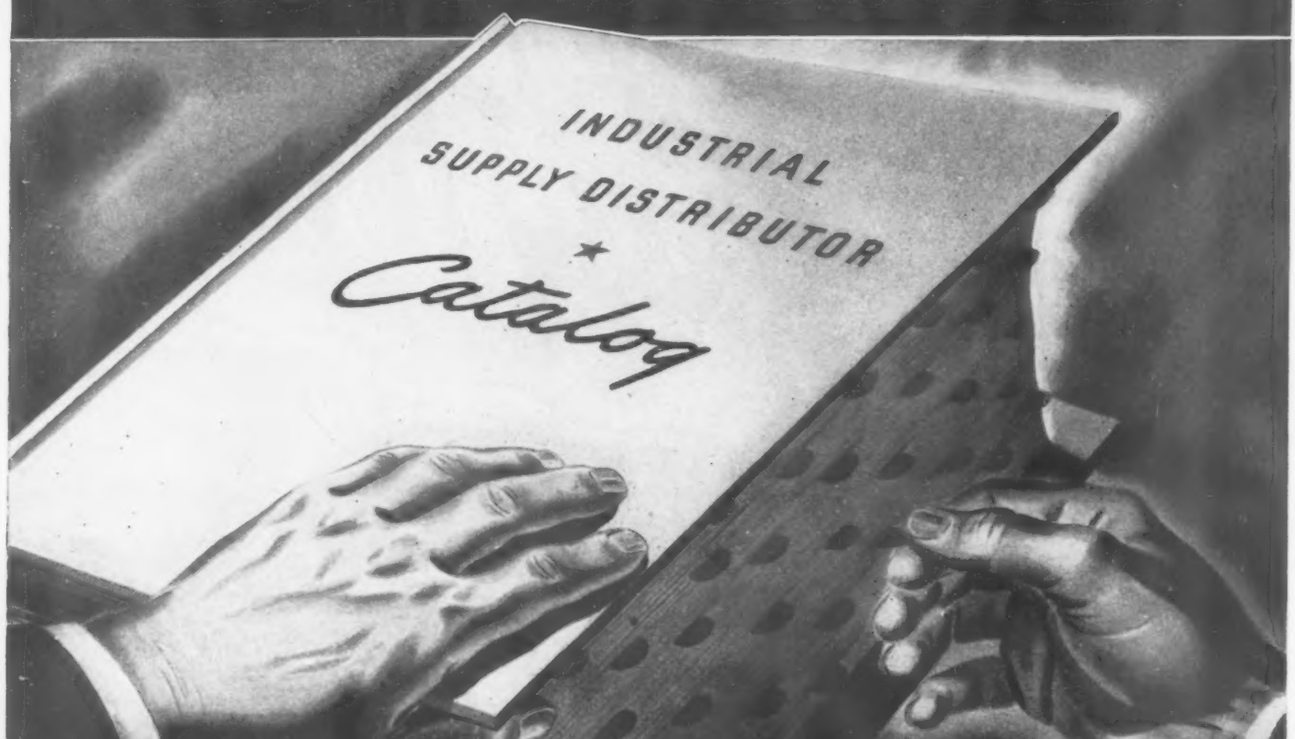
In the spirit of "all out" production — these new books are free to those who GIVE FIRM NAME.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

Do you realize what your own Distributor is doing to help you keep going today?



Your Industrial Supply House' big, modern Catalog is just as vital to your Purchasing Department as:

—your marketing records are to your Sales Manager

—accurate credit information is to your Accounting

—Production Charts and Cost Sheets are to your Management Executives

—because it provides one indispensable, central point for locating whatever you need in plant equipment and supplies.

Each of these big books may list 15,000, 25,000 or even more separate items—the Distributor normally carries many thousands of them in stock for immediate delivery to you.

Your Distributor has facilities and a trained staff to give you *specialized service*—he is in constant touch with scores of manufacturers producing every kind of plant machinery or supplies. He frequently can help your Purchasing Department to locate and expedite the materials you need most to keep your production schedules rolling.

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BOMBERS *start from here*

● Many of the mighty bombers and fighting planes for the American Air Force—for Britain, China, Russia—start in tool and production shops equipped with ***Cleereman*** Jig Borers and Drilling Machines. It is in these shops that skilled craftsmen, operating ***Cleereman*** machines, begin to build stamina, power and efficiency into American made aircraft.

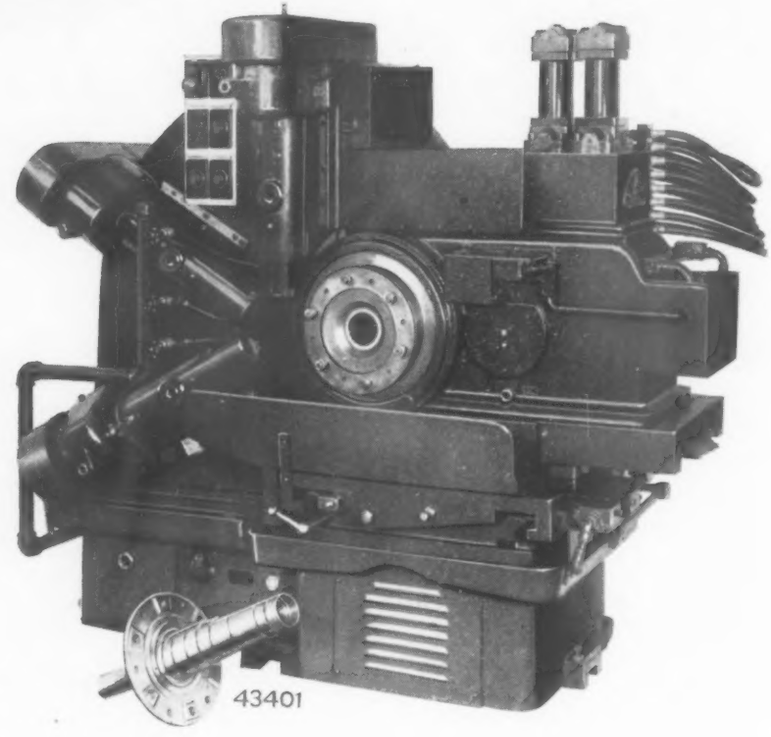
Bryant Machinery & Engineering Company
Sales Division of Cleereman Machine Tool Co.
400 W. Madison St. • Chicago, Ill., U. S. A

CLEEREMAN

DRILLING MACHINES and JIG BORERS

A 3-SPINDLE ROTARY MILLING MACHINE

Automatic Indexing • Full Hydraulic Operation



THIS machine is used in milling an undercut in the circular shoulder section of a turned propeller shaft hub, to produce six elevated rest pads. The machine is equipped with three milling spindles. The tools have tapered shanks, and, because of their small size, are further supported by outboard bearing.

The work cycle is as follows:

The work-piece is loaded and clamped in position hydraulically. The cycle starter button is pressed and the entire fixture assembly and work-piece are automatically moved by hydraulic power, along the main slide, into milling position.

When this position is reached, a transverse subslide, also hydraulically operated, automatically brings the workpiece into contact with the tools and feeds it forward until the required cutting depth is reached. At the same time, the piece is automatically rotated through the specified cutting arc.

When the cutting heads reach the required depth on the first three cuts, the fixture automatically retracts and rotates the workpiece 180°, into position for the second three cuts.

Upon completion of the six rough cuts, the fixture again retracts and the entire fixture assembly moved to the right, affording visual inspection of cutters and finish. The operator then throws a small lever which starts the machine through an identical second cycle in which the finish cut is made. The finish cut blends with the adjacent surfaces.

The entire operation is fully automatic except for loading and unloading and the throwing of the lever between first and second cycles. The rotation of the fixture during the milling cycle is accomplished through heavy duty hydraulic cylinders which give an adjustable feed rate for milling. This is a typical example of how Snyder engineering service solves complex processing problems. If you have a production problem to which a special automatic machine might be the answer, we invite your inquiries.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

designers and builders of machinery for HIGH production at LOW unit cost

IMPROVED

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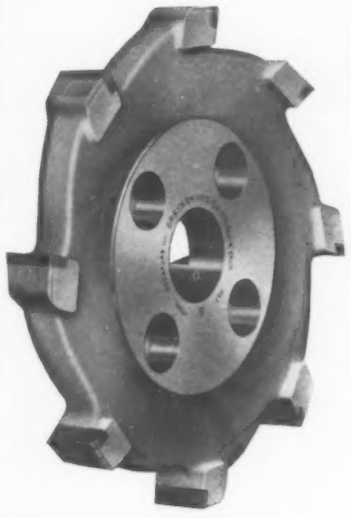
HAVE MADE POSSIBLE

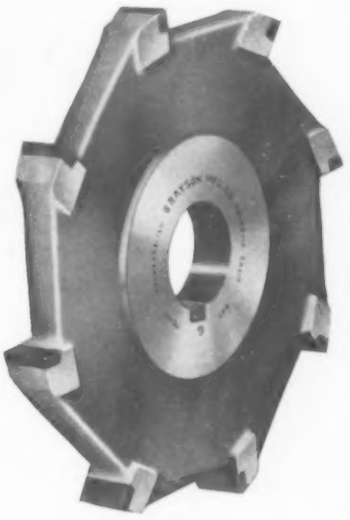
A NEW ERA

IN THE ART OF

METAL MILLING



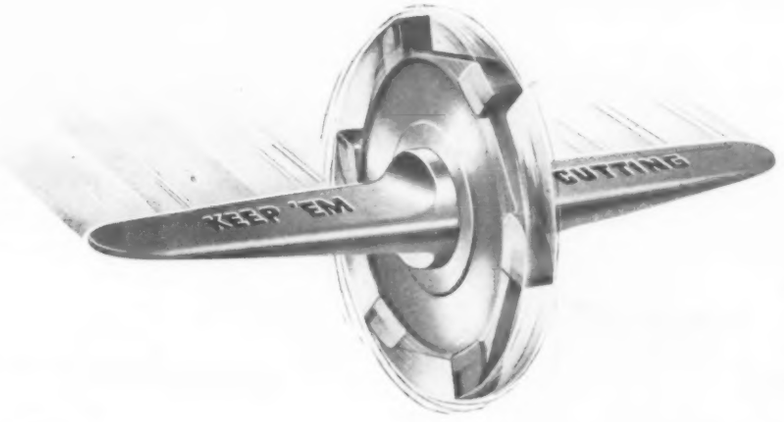
FACE MILL



SIDE MILL

MORE MILLING WITH LESS MACHINES

HARD and TOUGH developed FOR INTERRUPTED CUTS



Equally Good for CHILLED CAST IRON or ARMOR PLATE

Vibration and Chatter are reduced, instead of Amplified,
Due to the rare damping Qualities of

MEEHANITE

DOUBLE *SPEED PRODUCTION*

500% MORE PARTS PER GRINDING

PATENTS PENDING

THE FULL STORY ON REQUEST

HALF SIDE MILL

GRAYSON

MANUFACTURING CO.

MONROVIA CALIFORNIA

ROCKFORD, ILL. TALCOTT BLDG.

STAGGERED TOOTH SIDE MILL

HASKINS **Flexible Shaft Equipment**

MORE VERSATILE MACHINES for MORE PROFITABLE WORK

THERE are 30 different kinds of Haskins Flexible Shaft Equipment for every kind of work. There's the right power and the right drive for every job. There's the right mounting for every shop requirement. Any *one* kind of Haskins Equipment will do *many* kinds of work. On heavy or light duty grinding, sanding, polishing, rotary filing or wire brushing, Haskins will give you lower costs per man and machine hour. For full details and many applications, write for Catalog 45. R. G. Haskins Company, 2760 W. Flournoy Street, Chicago.

HASKINS *Versatile* FLEXIBLE SHAFT EQUIPMENT

What causes poor threads?

H&G CHECK CHART

1. *Misalignment of machines.*
2. *Poor camming or start.*
3. *Drag in machine.*
4. *Condition of Die Head*
   (Loose front plates, dirt under front plates if tightened without cleaning, worn locking mechanism, bent shank, etc.)
5. *Improper chaser grind.*
6. *Dull chasers.*
7. *Machinability of Stock.*
8. *Improper cutting oil or poor volume or direction.*
9. *Speeds.*

Free—

if you use H&G DIE HEADS

AS a part of our service we publish "DIE HEADLINES"—an informative bulletin packed with practical suggestions for improving production, quality and volume. Give description of machine and size and style of H&G Die Heads used with your request.

H&G DIE HEADS

The Eastern Machine Screw Corporation
20-40 Barclay Street, New Haven, Conn.

. . . and keeping pace with the ever increasing performance of our Air Force, are these 3 Spindle-No. 3 MA-6 (capacity of 1¼") cast iron, ball bearing Drilling Machines. Equipped with Aveymatic Power Feed.

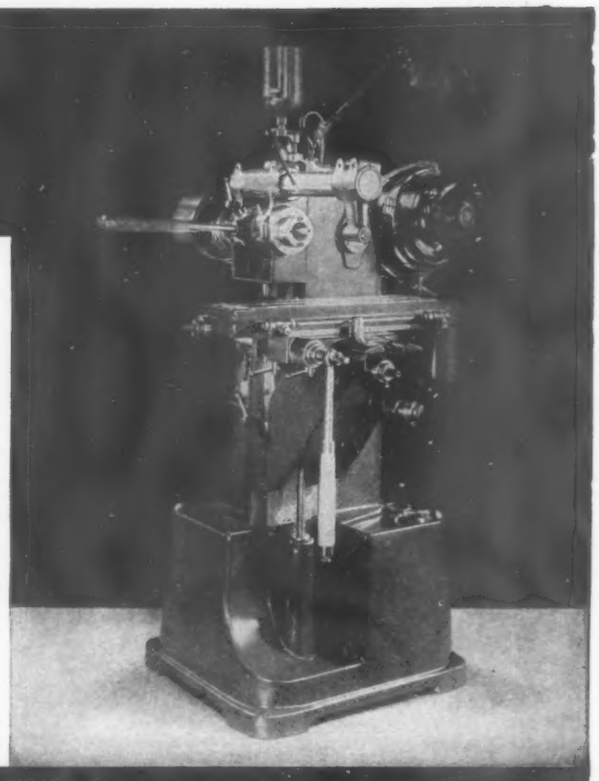
THE AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO U. S. A.

Avey DRILLING MACHINES
CINCINNATI · OHIO

★ ★ STEP UP PARTS PRODUCTION AT LOW INVESTMENT COST

. . . with the

NICHOLS HAND MILLING MACHINE



Substantial savings in production milling are assured by the Nichols Hand Miller—a precision machine which combines the usual features of conventional hand millers with the ruggedness and in-built accuracy of modern high production machine tools.

OUTSTANDING FEATURES INCLUDE:

. . . one piece box section column with adequate slides for head and knee integrally cast

. . . heavy box section. Knee with extra long dovetail slides for both vertical adjustment and horizontal traverse

. . . table, fitted with oil pockets at ether end can be operated from either side of machine and locked in any position; standard equipment includes micrometer table stops; table feed screw optional.

. . . hand operated vertical head fitted with hand set depth stop; can be locked in any position.

. . . spindle hardened and ground mounted on Timken Precision Roller Bearings

. . . capacity: longitudinal feed 10"; traverse feed 7".

» WRITE FOR COMPLETE DETAILED SPECIFICATIONS «

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*

CARD TAPS

The CARD Quality

ARE YOU INTERESTED IN BETTER TAPPING?

If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

The high quality of work done—the quantity produced—the economy of using Card Taps—will be apparent on any tapping job. Just put Card Taps to work and let them prove their superiority.

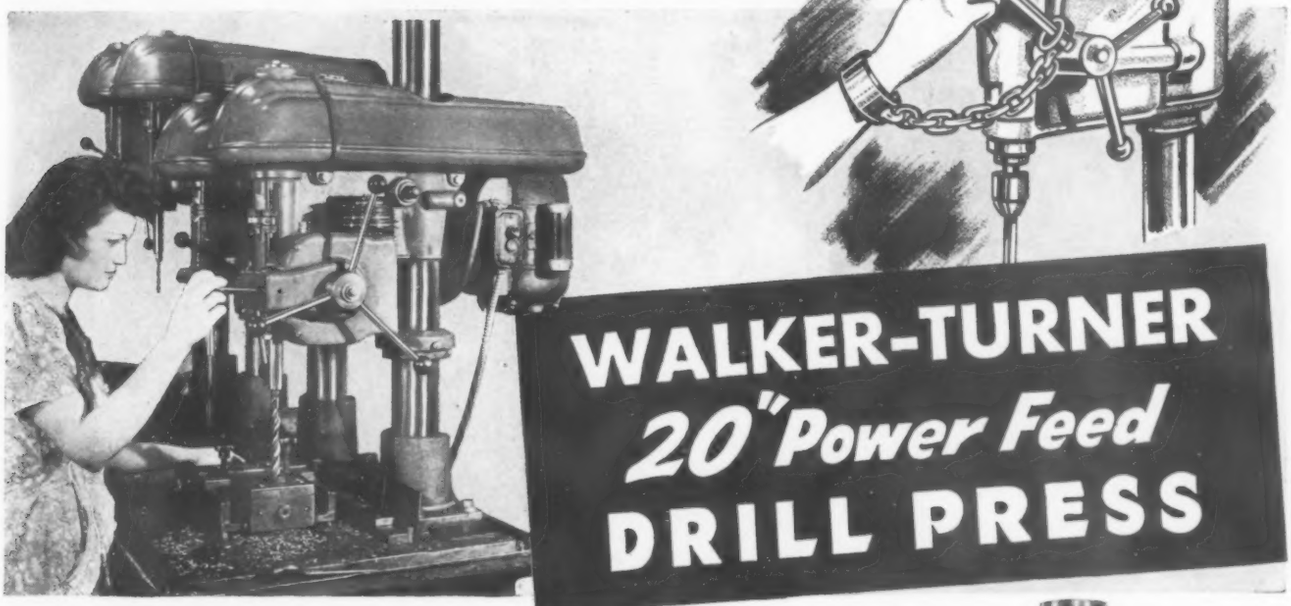
A regular catalog tap in most cases will meet your needs without using special taps. You'll find your requirements covered in the Card Catalog No. 34. Write for a copy.

Card taps are sold by leading dealers everywhere

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

STORES: New York: 61 Reade St., Chicago: 11 South Clinton St. Detroit: 6540 Antoine St., Seattle: 568 First Avenue, South Los Angeles: 168 South Central Avenue San Francisco: 121 Second St.

TAKE THE HANDCUFFS OFF YOUR DRILL PRESS OPERATORS!

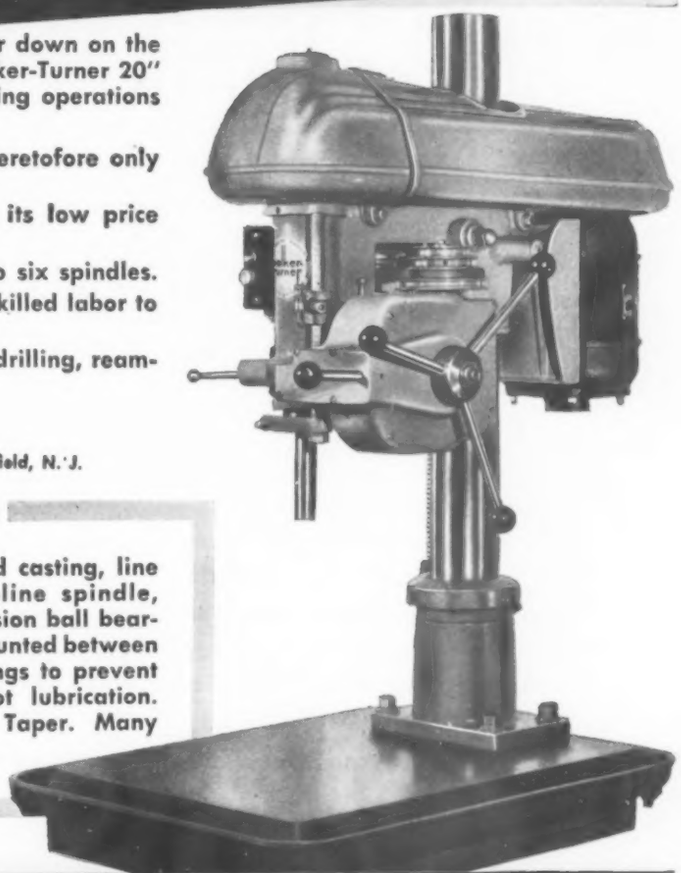


WALKER-TURNER 20" Power Feed DRILL PRESS

Don't handcuff your operators by making them bear down on the feed levers of hand-feed drill presses. The new Walker-Turner 20" Power Feed Drill Press is ideal for production drilling operations because:

1) **It is designed to standards of accuracy found heretofore only in much higher priced machines.**
2) **Large scale production methods make possible its low price ($255 up).**
3) **It is obtainable in multiple spindle models, up to six spindles.**
4) **Simple, streamlined design makes it easy for unskilled labor to operate with very little instruction.**
5) **It handles all of the usual drill press operations, drilling, reaming, tapping and counterboring.**

Write for literature and prices:
Walker-Turner Company, Inc.,
4592 Berckman Street, Plainfield, N. J.



SPECIFICATIONS

CAPACITY: Drills to center of 20" circle. Feed 6". Drills up to 1" in cast iron, ¾" in steel. Feeding speeds, .003", .006", .009", .012" per spindle revolution. Spindle speeds, 260-5200 r.p.m.

One piece head casting, line bored. Ten spline spindle, with four precision ball bearings. Pulley mounted between two ball bearings to prevent whip. One shot lubrication. No. 2 Morse Taper. Many other features.

walker-Turner
COMPANY, INC.
PLAINFIELD, N.J.
U.S.A.

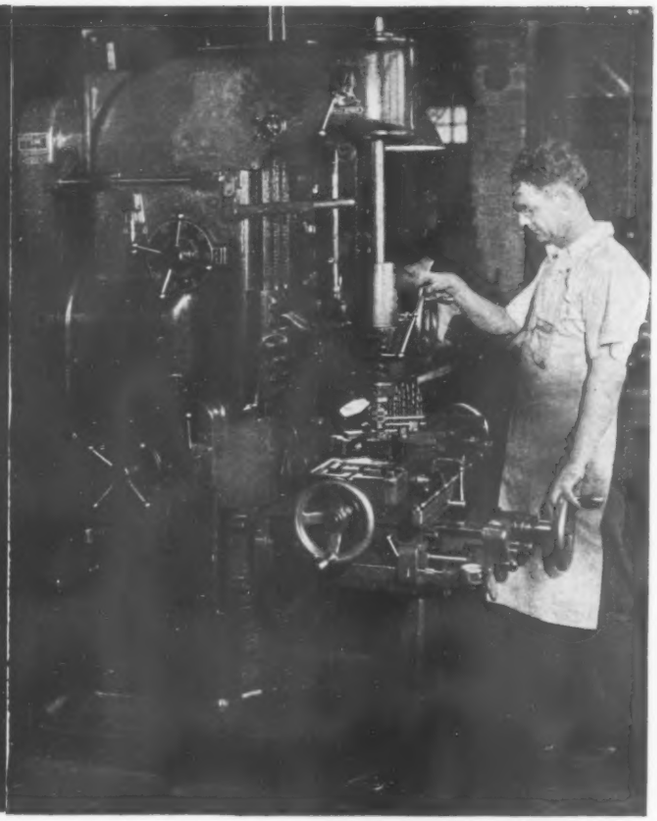
WALKER-TURNER MACHINE TOOLS
FOR METAL, WOOD AND PLASTICS

DRILL PRESSES · BAND SAWS · BENCH SAWS · TILTING ARBOR SAWS · LATHES
JIG SAWS · RADIAL SAWS · RADIAL DRILLS · BELT AND DISC SURFACERS · JOINTERS
SPINDLE SHAPERS · GRINDERS · FLEXIBLE SHAFT MACHINES · CUSTOM BUILT MOTORS

hurrying

PRODUCTION

ON LARGE RANGE OF WORK DEMANDED BY *Victory Program*



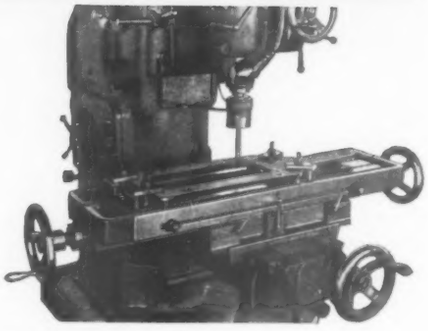
KNIGHT-Millers

The flow of work into your plant or shop now may call for an exceptional range of milling—drilling—boring—facing. You are equipped with the KNIGHT MILLER all-purpose milling machine, to handle this work faster, more conveniently, and more accurately.

Internal and external milling is done at one setting. Step milling is made easy by getting vertical adjustment on spindle. Profiling, boring, and slot-milling is all done at one setting. Precision boring is done, using dial indicators for accurate locating. Rigid spindle makes possible deep end milling. Jig boring is possible because of dial indicators.

Costs on experimental work are greatly reduced because you can machine many jobs completely on this one machine and handle difficult operations without special equipment.

For limited and special production you can keep costs down and maintain quality without special tooling. This is because the tilting table with Dial Indicators act as a Universal Jig and Fixture built into the machine.



SWIVELING TABLE
Gives Greater Capacity

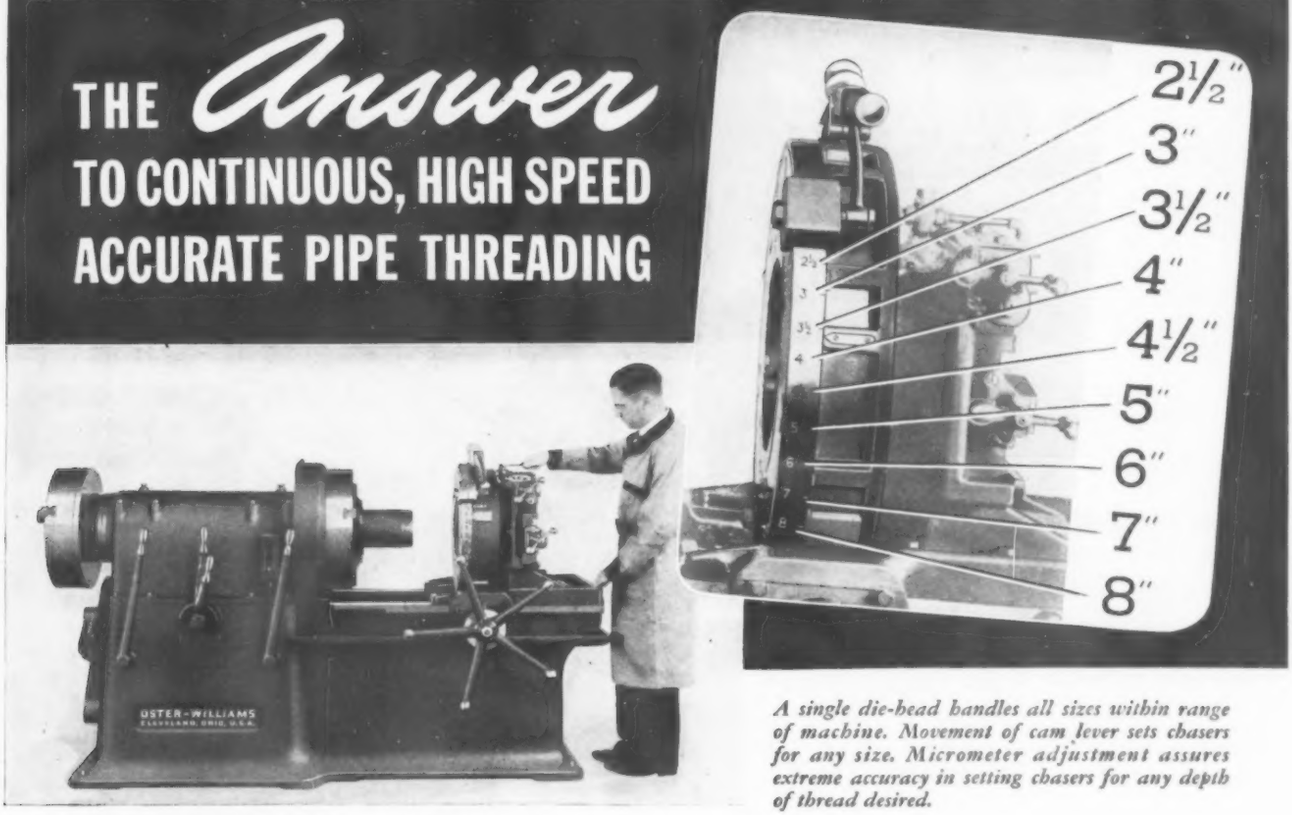
KNIGHT VERSATILE ACCURATE RIGID

The KNIGHT MILLER greatly reduces the most expensive element in tool room operation — time waste in set-up work. Also, you save money because it is not necessary to purchase special equipment for special work. This multi-purpose machine with the many attachments we make for it will enable you to handle an unusually large range of milling, drilling, boring, and facing work.

WRITE FOR NEW CATALOG

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

THE *Answer* TO CONTINUOUS, HIGH SPEED ACCURATE PIPE THREADING



A single die-head handles all sizes within range of machine. Movement of cam lever sets chasers for any size. Micrometer adjustment assures extreme accuracy in setting chasers for any depth of thread desired.

NOTE THESE SPEEDS!

Seconds required to cut full American National Standard pipe thread at recommended speed are indicated below. Pipe made of tougher material than standard should be run at slower speeds. Higher speeds may be used for finer pitches, smaller tapers and brass; and for cutting off.

No. 4 "Rapiduction"

Pipe Size	Seconds
1"	10.5
1¼"	10.7
1½"	15.4
2"	16.1
2½"	22.0
3"	32.2
3½"	33.3
4"	49.0

No. 6-A "Rapiduction"

Pipe Size	Seconds
1½"	11.3
2"	16.5
2½"	24.3
3"	25.3
3½"	33.4
4"	34.9
5"	52.6
6"	80.0

No. 8 "Rapiduction"

Pipe Size	Seconds
2½"	20.1
3"	29.8
3½"	30.8
4"	41.7
5"	44.4
6"	66.0
7"	80.0
8"	103.0

No. 12 "Rapiduction"

Pipe Size	Seconds
3½"	31.8
4"	46.6
5"	49.6
6"	64.3
7"	74.5
8"	86.7
10"	132.0
12"	190.0

OSTER

Speeds up PIPE THREADING

OSTER "RAPIDUCTION" Power Pipe Threading Machines

Do you need pipe threading speed? Get a *"RAPIDUCTION"!* But you must be assured of accuracy? *Get a "RAPIDUCTION"!*

What about sizes? "RAPIDUCTION" is made in four sizes. (See table at left.) What about special work requiring extreme accuracy? A lead screw attachment is available for pitches 8, 10, 11 or 11½ and 14; is extra equipment on machines, 4, 6-A and 8; standard equipment on machine No. 12. Also available (as extra equipment) is a taper attachment for A. P. I. Standard and other threads of longer than Briggs Standard Length.

But what are the FEATURES of these "RAPIDUCTION" machines? Too many to enumerate here. Why not fill in the form below, tear out, mail to us, Now?

THE OSTER MFG. COMPANY
2049 East 61st St. • Cleveland, Ohio, U. S. A.

Rush, by return mail, complete information about "RAPIDUCTION" Power Pipe Threading Machines.

Name .....

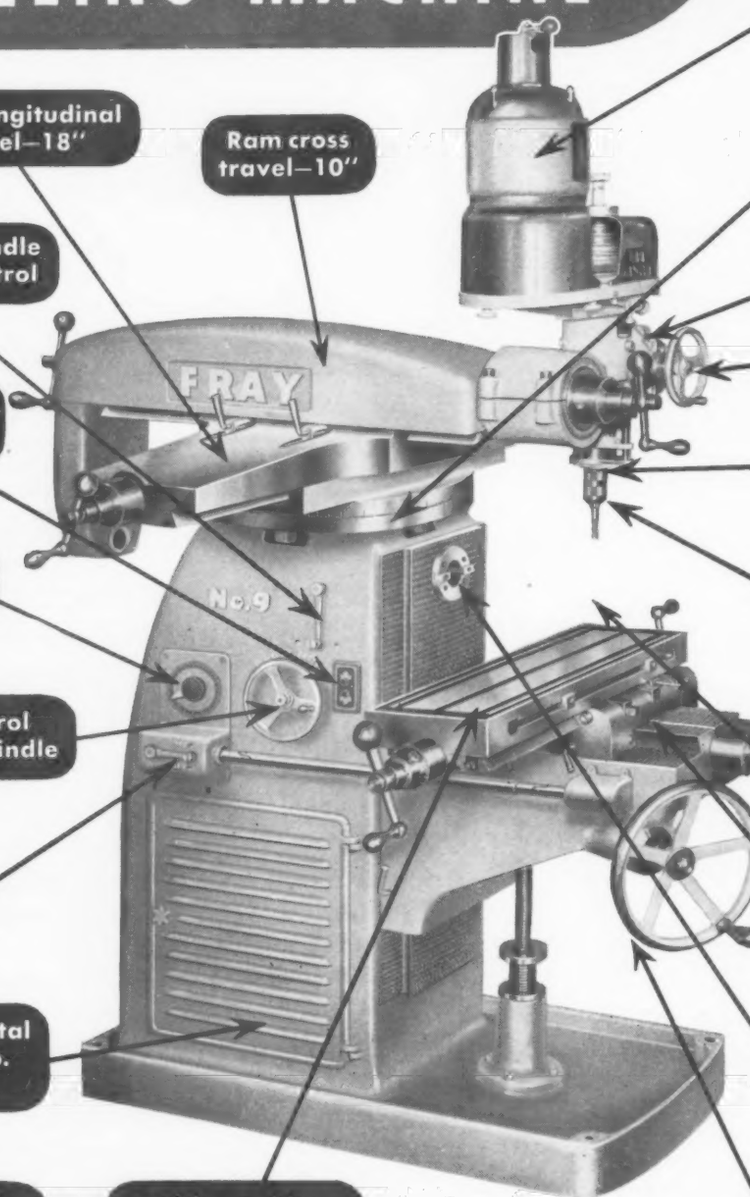
Address .....

City ..... *State* .....

FRAY RAM TYPE No. 9

HORIZONTAL AND VERTICAL MILLING MACHINE

VERTICAL HORIZONTAL



- Vertical head motor—1 h.p.
- Ram longitudinal travel—18"
- Ram cross travel—10"
- Turret Head Calibrated—360°
- Horizontal spindle back gear control
- Lever Feed
- Wheel Feed
- Main switch stop and start
- Quill travel—4"
- Table feed speed control
- Vertical spindle No. 9 Brown & Sharpe No. 3 Morse—optional
- Speed control horizontal spindle
- Nose of spindle to top of table Minimum—0" Maximum—16"
- Power feed to table
- Cross travel—9"
- Motor, horizontal spindle—3 h.p. (in base)
- Horizontal spindle Nat. standard No. 40 taper
- Coolant pump—optional
- Table working surface—9½"x36" Longitudinal travel—20"
- Weight—3800 lbs.
- Vertical travel—16"

★ *Write for literature*

FRAY MACHINE TOOL COMPANY

517 W. Windsor • Glendale, California

GEOMETRIC

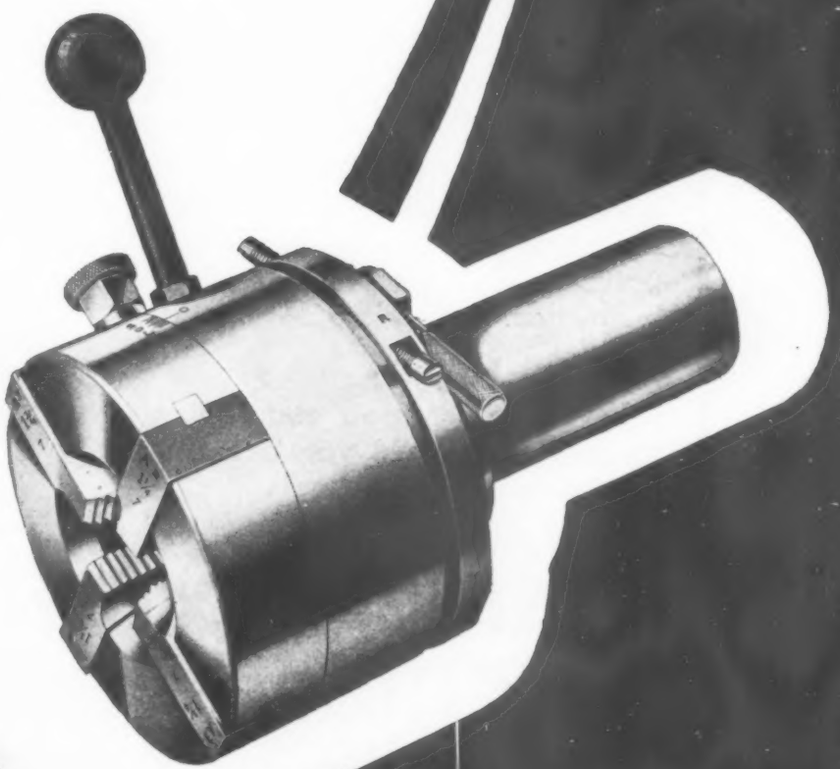
Style "D" for Speed and Accuracy on Coarse Pitch Threading Jobs

Keep production speeds *up* and accuracy *high* on large diameter, coarse pitch threading jobs! Use Geometric Style "D" Die Heads for all threads up to 3½" in diameter, any length up to the limits of your machines. A special roughing and finishing attachment on all sizes ¾" and larger allows two cuts to be taken on coarse pitch threads, increasing accuracy and reducing the load on tool and machine. Every part but the shank is accurately hardened and tempered. Chasers, designed for easy removal and accurate adjustment, are tested in actual use before they are passed by our strict inspection department.

Geometric Style "D" is a precision tool —and a rugged one—from chaser to shank, built for speed, power and precision that add up to economy on all types of threading jobs.

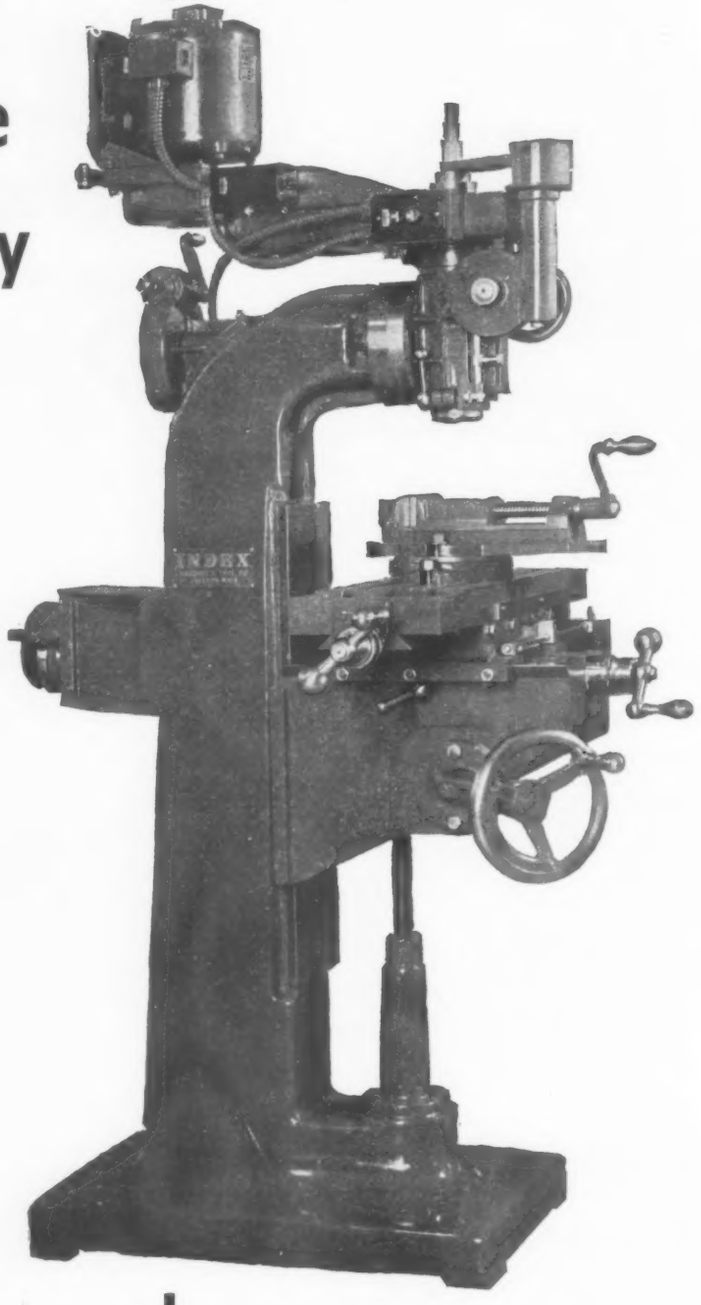
The Geometric Tool Company

New Haven, Conn., U. S. A.



Nine sizes give a range of threads from ⅛" to 3½" in diameter. This is one of the few tools built to cut National Coarse threads in large diameters; for example, 2"-4½ and 3"-4 threads per inch. Absence of a face plate permits threading right up to a shoulder. Cam-controlled, precision chasers open and close uniformly and instantaneously.

A Simple and Practical Machine For Approximately $1000.00



That was the original idea of the Index Machine & Tool Company in bringing out the 40-H INDEX.

Rugged and fast for its class. Designed to do end mill work with end mills from ⅛" to ⅝" in tool steel. With a spindle running in super precision pre-loaded ball bearings . . . with verniers for locating . . . with power feed to spindle for boring.

This has now long been an accomplishment, TRIED & PROVEN by hundreds of Defense Plants on parts for all kinds of war equipment from binoculars to battle ships.

If you do not know about this machine you should write at once for full particulars from

BLANK & BUXTON MACHINERY CO.

3100 E. MICHIGAN AVE. • JACKSON, MICH.

The NEW #42 MURCHEY THREAD MILLING MACHINE

. . . for mass production of accurate, concentric external and internal threads from 4" to 12" diameter

This new machine meets the ever increasing demand for larger threads of extremely close tolerance produced uniformly with absolute concentricity.

PERFECT CONCENTRICITY

Internal or external surface being threaded remains concentric with the O.D. or I.D. because work does not revolve or move in any way. On this machine, the milling hob revolves eccentrically about the work and simultaneously rotates on its own axis until the cutting teeth of the milling hob are advanced into the work sufficiently to produce the required depth of thread.

When full depth has been attained and the milling operation completed, the cutter spindle automatically returns to center permitting facing and counterboring operations with guaranteed concentric relation of thread.

Outstanding Features Contributing to Fast, Precision Work and Long Life

. . . hardened and ground lead screw mounted direct on eccentric spindle bushing.

. . . rugged heavy construction throughout with sliding table mounted on amply large ways.

. . . fixture table provided with two "T" grooves and one keyway which is used only for locking purposes. "T" grooves used only to bolt fixture to table.

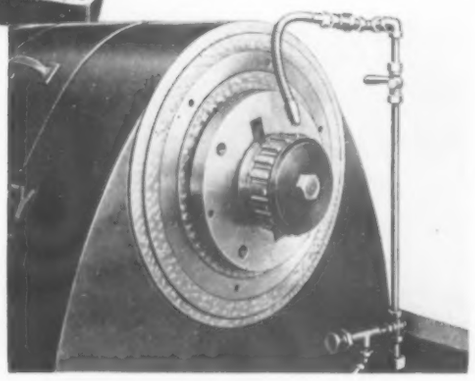
. . . all controls conveniently located near head.

. . . large spindle hardened and ground and mounted in Timken preloaded roller bearings.

. . . outer eccentric spindle sleeve runs in adjustable special phosphor bronze taper bearings.

. . . complete hydraulic unit actuates cutter feed and cutting cycle.

. . . machine may be stopped at any point in its automatic working cycle.



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CONDENSED SPECIFICATIONS

Capacity: 4" to 12" dia. external or internal threads

Eccentric motion of spindle: 0" to ¾"

Speeds of Cutter Spindle: 33 to 645 R.P.M.

Floor space: 371½" x 100"; height 57"

Table size: 21" x 30".

•

Murchey MACHINE & TOOL CO. . . . . DETROIT, MICHIGAN

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.

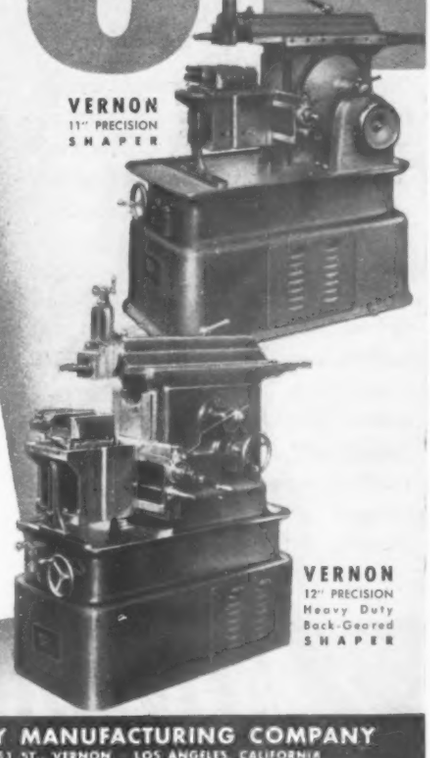
Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

VERNON

VERNON
NO. 0 PRECISION
HORIZONTAL MILL

VERNON
VERTICAL MILL
AND JIG BORER



VERNON
11" PRECISION
SHAPER

VERNON
12" PRECISION
Heavy Duty
Back-Geared
SHAPER

SIMPLICITY
Because all Vernons are simply designed, new help finds them easy to operate, quickly bringing production to peak machine capacity.

EFFICIENCY
Compact design saves valuable floor space. Low consumption power plants drive through heavy cuts. Modern drives provide wide speed range, and quick changes.

SAFETY
All Vernons are designed with safety in mind. Fully enclosed drives prevent injury from open belts and pulleys.

★ Bulletins are available on each Vernon tool, write today!

See the VERNON LINE—Dealers in all important industrial areas. Deliveries are being made Promptly!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON LOS ANGELES, CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

HOW GORTON saves time ON PROFILE MILLING WITH SEMI-SKILLED OPERATOR

GORTON

9-J Super-Speed Vertical Mill with Duplicator Table and Tracer Profiles Crankshaft Part in 15 Minutes Floor-to-Floor Time

• This prominent airplane engine manufacturer (name on request) utilizes semi-skilled help for operating Gorton Super-Speed Milling Machines and Duplicators. The operation being performed is *Profile Milling of a .738" Radius on the Rear Section of a Steel Crankshaft.* Feed is by hand, spindle speed is 500 r.p.m. using a special .738" diameter four-fluted ball cutter. (This cutter is ground on a Gorton 375-2 Cutter Grinder.)

This is an excellent example of the ease of operation of Gorton High-Speed Millers and Duplicators in performing unusual operations.

AN EASTERN MANUFACTURER OF TOOLS AND DIES WRITES: "... MOST IMPORTANT TODAY IS THE FACT THAT WE CAN USE WOMEN TO OPERATE THESE MACHINES."

These are but two of many ways in which Gorton Super-Speed Milling Machines are saving vital man hours on form milling. Perhaps you, too, can save additional hours on your present or new milling equipment. Gorton Engineers, specialists in Vertical High-Speed Milling, will be glad to make recommendations on your work—without obligation.

SUPER-SPEED MILLING DATA

OPERATION—Profile Mill .738" Radius.

MACHINE—Gorton 9-J Super-Speed Vertical Mill with Duplicator Table and Tracer.

PART—Rear of Crankshaft—Steel.

CUTTERS—Special .738" dia. Ball Cutter—Profile Form Type—4 Flute

HOLDING—Special Fixture.

FEED—Hand.

SPINDLE SPEED—500 r.p.m.

STOCK REMOVED—1/8".

FLOOR-TO-FLOOR TIME—15 Minutes.

FREE

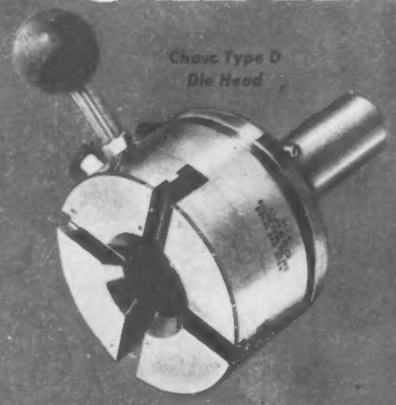
Additional data and specifications are included in this booklet. Write for your copy today. Ask for Catalog No. 1400-B.

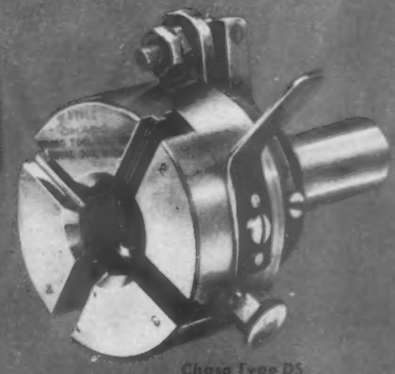
GEORGE GORTON MACHINE CO.

1315 RACINE STREET, RACINE, WISCONSIN, U.S.A.

SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

CHASO Threading Tools





IT'S *Chaso* FOR CHASERS!

We make chasers for most of the well-known makes of self-opening die-heads.

● CHASO CHASERS must prove satisfactory in order to fulfill the CHASO guarantee for quality, workmanship and accuracy. It means also that users of CHASO THREADING TOOLS *must* obtain better service in terms of more threads of closer accuracy between grinds.

● CHASO production methods assure the satisfactory performance of CHASO CHASERS AND DIE HEADS. Write for our catalog.

CHASO TOOL COMPANY, Inc. *Royal Oak, Michigan*

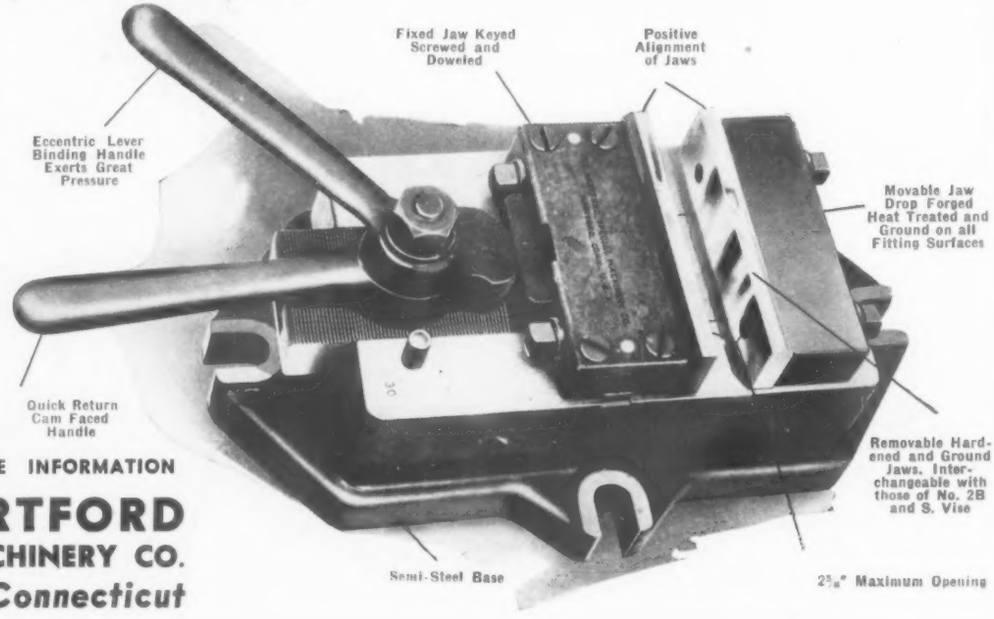
SPEEDIER PRODUCTION *and* GREATER ACCURACY *assured by the* HARTFORD MILLING VISE

Power, speed, accuracy and strength are combined in this fast, convenient vise which is particularly adaptable for small arms milling. A dual handle provides quick opening and powerful holding. With a little practice the operator locks both handles with one hand.

The "HARTFORD" is made in plain and swivel types. All parts are made with tools to gauges making it possible for us to furnish interchangeable replacement parts promptly.

SPECIFICATIONS

Jaw width—5"	Max. opening (Swivel)
Jaw depth—1 3/16"	Jaws in place—2¼"
Max. opening (Plain)	Weight—40#
Jaws in place—2⅝"	Length—13"
Jaws removed—3½"	Width—8"
	Height—5"

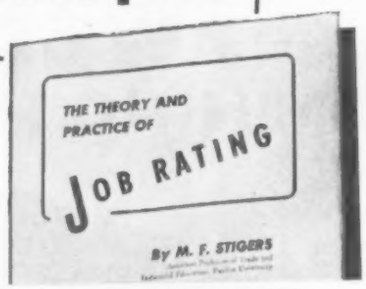

Fixed Jaw Keyed Screwed and Doweled
Positive Alignment of Jaws
Eccentric Lever Binding Handle Exerts Great Pressure
Movable Jaw Drop Forged Heat Treated and Ground on all Fitting Surfaces
Quick Return Cam Faced Handle
Removable Hardened and Ground Jaws. Interchangeable with those of No. 2B and S. Vise
Semi-Steel Base
2⅝" Maximum Opening

WRITE FOR COMPLETE INFORMATION

***The* HARTFORD**
SPECIAL MACHINERY CO.
Hartford, Connecticut

How to rate jobs

- for greater incentive
- for increased production
- for balanced purchasing power
- for better employee relations



JUST PUBLISHED

HERE is a book to help you rate every job in your plant accurately, set wages scientifically on such a job-rating plant, measure even the so-called intangibles on any job. It is the first published in this country to give a basic understanding of the fundamentals or theory of the actual practice of job rating and to present an accurate and scientific technique for the actual work of job rating.

The Theory and Practice of Job Rating

By M. F. Stigers, Purdue University, and E. G. Reed, Reed Laboratories, Inc. 154 pages, $1.75

Noteworthy for its original and unusually factual approach to job rating, this book offers an accurate, practical means of measuring every job element—including the intangibles heretofor considered unmeasurable. The fundamentals and philosophy underlying the subject are discussed; a scientific technique for the actual evaluation work is given; and questionnaires, rating scales, a cross comparison procedure, and pertinent data, plus full instructions, are provided. Employers and employees alike can understand this approach, and appreciate its substitution of facts for the opinions of rators. See how you can use it; send for a copy of the book to examine and read, today.

Some questions answered in this stimulating book

—should not wages be set on supply and demand instead of being based on the results of a theoretical calculation?

—what should be done to a rate when there is a temporary shortage of skilled labor to fill a special job?

—why not pay the "going rate" of the community?

—what effect should profit and loss have on wages?

—can the value of all types of labor and of technical and managerial positions be calculated?

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. C.

Send me Stigers and Reed—Theory and Practice of Job Rating for 10 days' examination on approval. (In 10 days I will send $1.75, plus few cents postage, or return book postpaid. (Postage paid on cash orders.)

Name .....

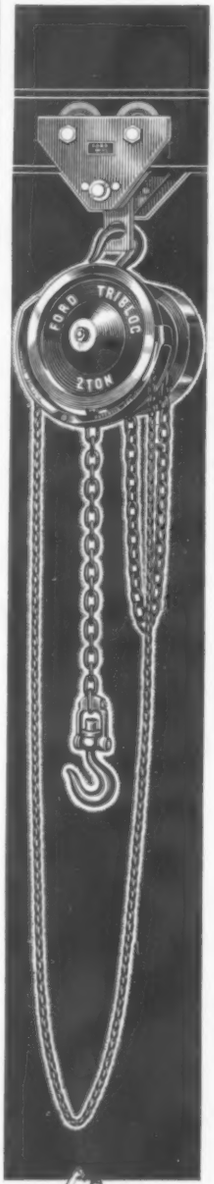
Address .....

City & State .....

Position .....

Company ..... A. 9-8-42

Keep those FORD Tribloc PRIMED FOR UNCLE SAM!



Here's How!—

FORD TRIBLOCS withstand abuse amazingly well—but this is certainly no time to abuse *anything* made of critical materials. Like any other precision-made machine **FORD HOISTS** will give more efficient service for a longer time if properly maintained. In **FORD HOIST** maintenance, lubrication is perhaps the most important single factor—so here are a few pointers on lubricating **FORD TRIBLOCS**.

- **The gear cover should be removed occasionally and a small quantity of heavy graphite grease added.**
- **The load chain should be lubricated frequently with a heavy oil, particularly at engaging points of links.**
- **Load sheaves should also be well greased.**
- **Oil the bearings frequently so that no bearing will run dry and cause excessive wear.**
- **Five oil holes are provided in the TRIBLOC and these should be filled frequently.**

When given intelligent care, thoroughly lubricated and cleaned at intervals, **FORD TRIBLOCS** will remain efficient under the hardest usage for a long time. Your **FORD HOIST** can be one of your best friends during this production emergency. Take care of it.

Order from your distributor

FORD CHAIN BLOCK DIVISION
PHILADELPHIA • CHICAGO
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In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
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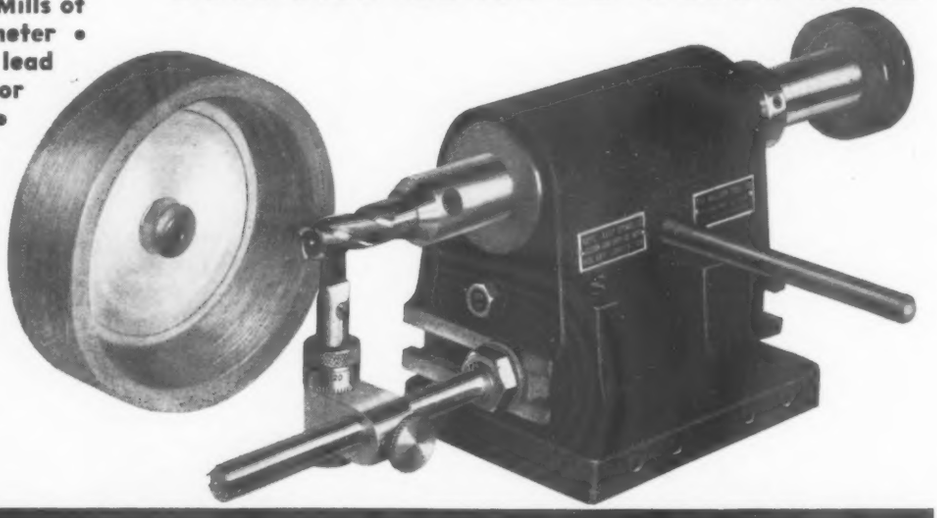
END MILLS ARE SCARCE...MAKE 'EM LAST

Use your WELDON SHARPENING FIXTURE

COMPLETE!
SELF-CONTAINED!

Quickly re-sharpens End Mills of 3/16" to 1¼" shank diameter • Requires no centers or lead cams • Releases major production equipment • Designed for any grinder with flat table • No table movement necessary • Operated by trained or unskilled workers • Provides tool conservation — a vital war factor.

SIMPLE!
CONVENIENT!
FLEXIBLE!



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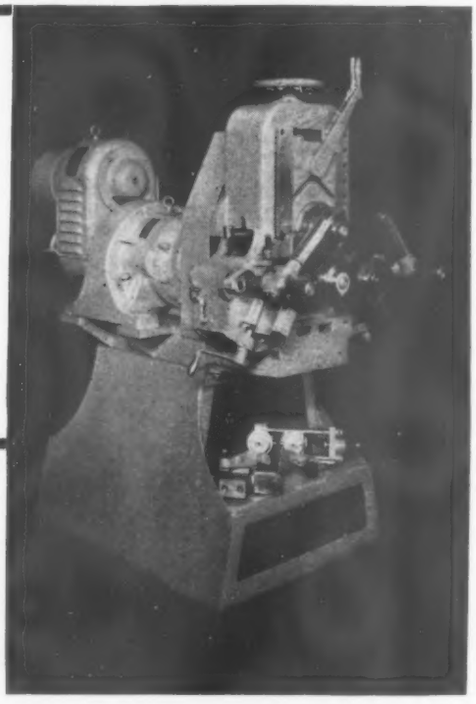
3002 WOODHILL ROAD • CLEVELAND, OHIO
"Yesterday's Pioneer — Today's Leader"

END MILLS • GROUND CIRCULAR AND FLAT FORM TOOLS • SCREW MACHINE CAMS • "TU-LIP" COUNTERBORES

Simplifying

COMPLICATED BENDING JOBS

FOR AIRCRAFT PRODUCTION

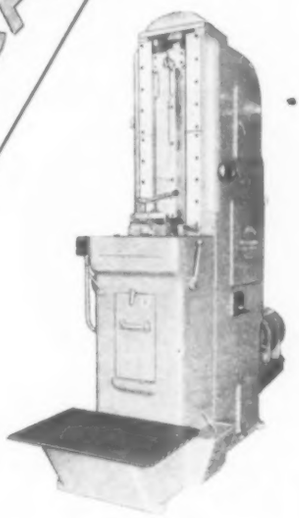


★ The aircraft industry is today relying on Buffalo *Aircraft Type* Bending Rolls to maintain all types of bending assignments on a fast production basis. Designed with exceptional simplicity of control and a wide range of speed, Buffalo *Aircraft Type* Bending Rolls are efficient allies in the aircraft "Battle of Production."

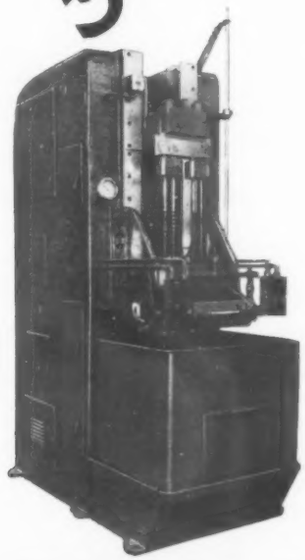
BUFFALO FORGE COMPANY
448 BROADWAY BUFFALO, N. Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

★ ★ ★

"Buffalo" **BENDING ROLLS**



Banking on AMERICAN for INCREASED PRODUCTION



Many producers of war materials have come to "Bank on American" for greater output. In these time of labor shortages it is imperative that maximum production be obtained with semi-skilled or unskilled help. It is significant, therefore, when a single American Broaching Machine can often replace a battery of other machines and give equal production results.

The AMERICAN T-10-36 3-way type machine, shown at upper right, is arranged for surface broaching flats on the breech end of carbine barrels at a high rate of production.

The machine shown at the left is an AMERICAN VP-4-25 ton 36" stroke vertical hydraulic broaching machine arranged for broaching two $1\frac{1}{8}$" diameter holes 1-13/16" long through tank track end connectors.

AMERICAN BROACH & MACHINE COMPANY
ANN ARBOR, MICHIGAN, U. S. A.
BROACHING MACHINES, PRESSES, BROACHING TOOLS, SPECIAL MACHINERY

Division of SUNDSTRAND MACHINE TOOL CO. ROCKFORD ILLINOIS U.S.A.

"The boys here call it the *FOURTH SHIFT!*"

. . . and you do it with

FLEUR-O-LIERS

When you define fluorescent lighting with FLEUR-O-LIERS in terms of better, faster seeing—more accurate work—spoilage reduced—production speeded and manhours saved—the phrase "fourth shift" has a real significance.

Fixtures bearing this FLEUR-O-LIER label assure you maximum use of your lamps—plus electrical and mechanical dependability. That's important these days when every minute counts—and equipment *must* stand up!

And here's the reason. Though nearly 50 independent fixture manufacturers make FLEUR-O-LIERS, *they all make them* to 50 definite specifications set up by the makers of MAZDA Lamps. And FLEUR-O-LIERS meet these specifications as tested and certified by impartial Electrical Testing Laboratories.

A vital tool in wartime production, fluorescent fixtures now require a suitable WPB priority rating. Any of the FLEUR-O-LIER Manufacturers, your electrical contractor, wholesaler or electric service company will be glad to work with you.

DEPENDABILITY COUNTS!

See why you get it in FLEUR-O-LIERS

- **Certified ballasts and starters**... assuring balanced, economical operation—most light from your lamps—high power factor (over 85%).
- **Durability and Safety**
- **Ease of maintenance**
- **Maximum light output**
- **Flicker correction** (on two-lamp circuits).
- **Correct ventilation**
- **Every unit** carries the FLEUR-O-LIER Manufacturers' Guarantee.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

Fleur-O-Lier Manufacturers, 2133-9 Keith Bldg., Cleveland, O.
Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name _____

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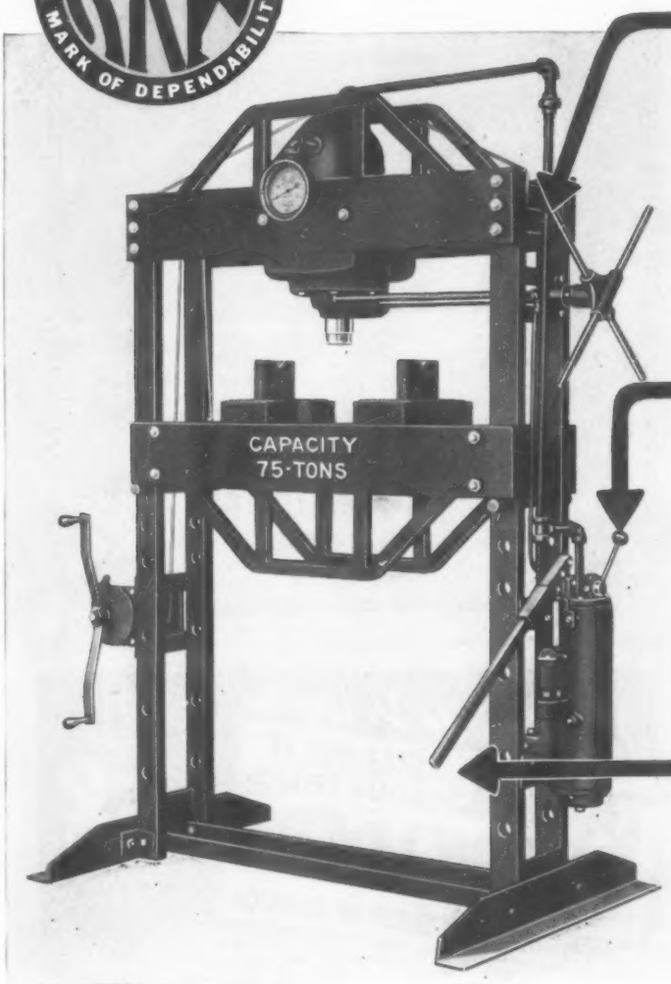
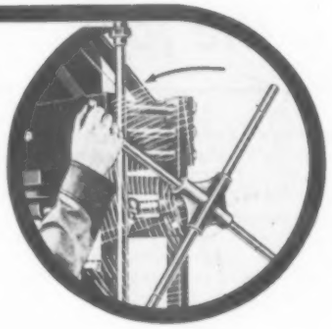
Here's how SPEED is built into HYDRAULIC ARBOR PRESSES

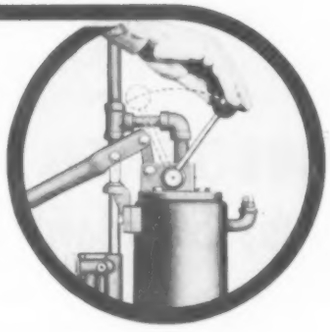
SINCE 1916 KRW A MARK OF DEPENDABILITY



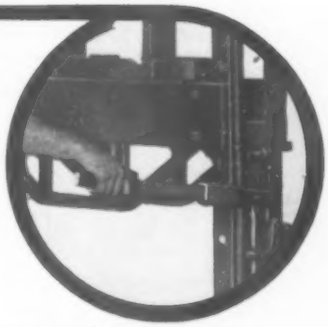
1 **SPIN THE HANDWHEEL** and the ram speeds to the work by fast mechanical action instead of slow, laborious hydraulic pumping.



2 **FLIP THE BALL ARM** to close the valve instead of slowly turning a handwheel type control.



3 **START PUMPING** and immediately get tons of pressure on the work because the hydraulic cylinder was automatically filled with oil during operation No. 1.



● The new KRW Presses are designed for SPEED... *speed* in bringing ram to the work ... *speed* in developing hydraulic pressure... *speed* in raising ram to remove the work. The "capstan" type handwheel raises the ram with the same mechanical speed employed in lowering it.

A *Two Speed Pump*, controlled by a quick, half turn of a finger lever, enables operator to select the speed best suited to the job—the double plunger action is 2½ times faster than the single action. Write for bulletin describing 25, 50 and 75 ton presses—priced from $198.00*.

*Prices F. O. B. Arcade, N. Y. Slightly higher west of Rockies

K. R. WILSON

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How can you be sure of CHOOSING THE BEST WORKER *for the job?*

Just Out!

Increased demands for speed and quantity of production—scarcity and inexperience of labor—and other conditions complicate the job of hiring and placing people today. *But Charles Drake has discovered, developed, and here presents a new approach to aptitude testing to help you meet these problems.*

No highly specialized knowledge, needed in applying many other testing methods, is required. Utilizing data available in your plant, you can design tests of unusual simplicity and directness, that will pay big dividends in disclosing the most capable and trainable applicants and employees.

Learn how, quickly, from this concise, readable new book . . .

PERSONNEL SELECTION by Standard Job Tests

By CHARLES A. DRAKE
Head, Methods Department, United Merchants and Manufacturers Management Corporation

140 pages, 6x9, illustrated, $2.00

Here is a new, realistic, and practical technique for the selection of industrial personnel. The methods consist primarily in designing special performance tests embodying the essential elements of dexterity and perception discovered by analyzing an industrial job or a group of similar jobs. The treatment is concise and clear, and many illustrations of actual tests provide a usable guide for industrial engineers, personnel workers, and others in employing this technique.

Look over these chapters

Introduction — Management as a Practical Art
1. **Backgrounds of Job Testing**
2. **Human Abilities and Industry's Problems**
3. **Hand-foot coordination**
4. **Inspection**
5. **Perception**
6. **Dual Coordination**
7. **A Machine-operator Test**
8. **Some Standard Job Tests**
9. **Motor Skills and Production**
10. **Tests and Learning Ability**
11. **Aptitude and Skill**
12. **Measurement of Accident-proneness**
13. **How to Construct Tests**
14. **Summary and Forecast**

SHOWS YOU:

- how to design simple tests based on the actual manual abilities and perceptions required in a job or group of jobs.
- the basis of the method and how it compares with other types of testing.
- principles, methods, and examples of test design and operation.
- methods of scoring and interpreting results.

10 DAYS' FREE EXAMINATION

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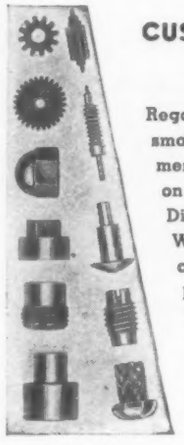
demands complete cooperation of every industry, every manufacturer, every single person . . . The Waltham Watch Company is ready to serve you with custom-made parts to closest tolerances.



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Regardless of your small parts requirements, you can depend on the Custom Parts Division of Waltham Watch Co. . . . Our men are ready to help you break those "bottlenecks" that are so bothersome. Send us your specifications for small parts.

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Waltham, Mass.

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EASY TO OPERATE

Easy for factory men and women to strike an arc and run a welding bead with our simplified instructions. Just plug it into any 110 or 220 volt circuit.

ALL THIS FOR $58.00
TRINDL Welder
Head Shield
Electrode Holder
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Welding Rods

Lowest Cost Production Equipment

Welding speeds up war production schedules 20% to 40%. Increase your production with this TRINDL welder . . . *even a few repair jobs will make it pay for itself.* Handles 5/32" rod—110 or 220 volt 60 cycle AC—10 to 125 amp. output—16 heat ranges—so portable you can work anywhere with it—ONLY $58.00 COMPLETE. Other TRINDL Welders up to 300 amp. output ready for immediate delivery.

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Manufacturers of all Welding Equipment and Supplies
2227-D Calumet Avenue **Chicago, Illinois**

LARGE JOBS
SMALL JOBS
SPECIAL JOBS

Swaging
HANDLES THEM ALL SATISFACTORILY!

Here's a large job . . . this ETNA Swaging Machine is turning out large axle housings at a rapid rate . . . reducing one section from 4½" O.D. to 3" O.D., while increasing wall thickness from ¼" to .360". Tubes are automatically fed.

Here's a small job . . . the swaging of a narrow copper band around a 20 m.m. shell. Production rate is surprisingly high.

Here's a special job . . . a single ETNA doing three operations on an army cot leg. First, the design is knurled on. Second and third operations consist of tapering and sizing the ends of the leg. Production rate —50 legs per hour.

Here are three of the jobs upon which ETNA SWAGING MACHINES are being actively employed today. These three examples represent only a small percentage of the varied work that ETNAS are doing. But they serve to demonstrate how and where you can save by Swaging. Particularly today, when all-out speed is needed to meet urgent war needs, Swaging is important. You can often eliminate machining operations . . . improve quality . . . increase output by Swaging with ETNAS.

Therefore, it's well to remember—if you taper, size or reduce round solids or tubing . . . if you fabricate small tubular assemblies . . . investigate Swaging . . . ask ETNA. Swaging Machines by ETNA are built in standard sizes with die lengths up to 18", and diameters up to 8". Larger units are built to order. Write, wire or phone today!

IF IT'S A QUESTION OF TAPERING, SIZING OR REDUCING OF ROUND SOLIDS OR TUBING

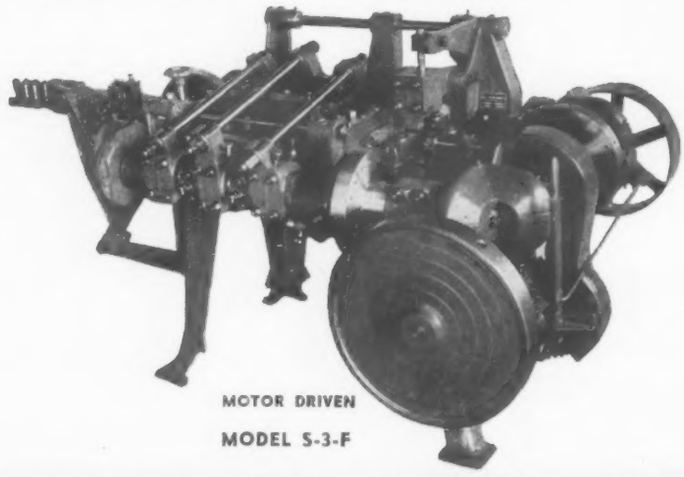
"Ask ETNA about Swaging"

THE ETNA MACHINE COMPANY

TOLEDO . . . OHIO

NILSON *Automatic Metal and Wire Forming* MACHINES

. . . assuring faster work and greater uniformity in parts produced . . . . . .



MOTOR DRIVEN
MODEL S-3-F

The new Nilson Ribbon Stock Forming Machines are a development—the result of more than fifty years specialization in the design and building of metal forming machines. They can be depended on for speed, durability and accuracy and are built in 4 sizes for handling from 3/32" to 1¼" in diameter and stock from 1¼" to 2½" wide.

Outstanding features include:

. . . open construction of the press and forming tools
. . . patented slide feed has independent cam-operated wire gripping device
. . . power operating wire feed is transmitted through a straight line.

ILLUSTRATED BULLETIN GIVING DETAILED SPECIFICATIONS . . . .

available on request

Nilson is prepared to design and produce special automatic machinery of high productive capacity. Our long experience in this class of work enables us to offer an expert and comprehensive service on special machines. Outline your problem—ask for our recommendations.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

A COMPLETE ENGINEERING SERVICE

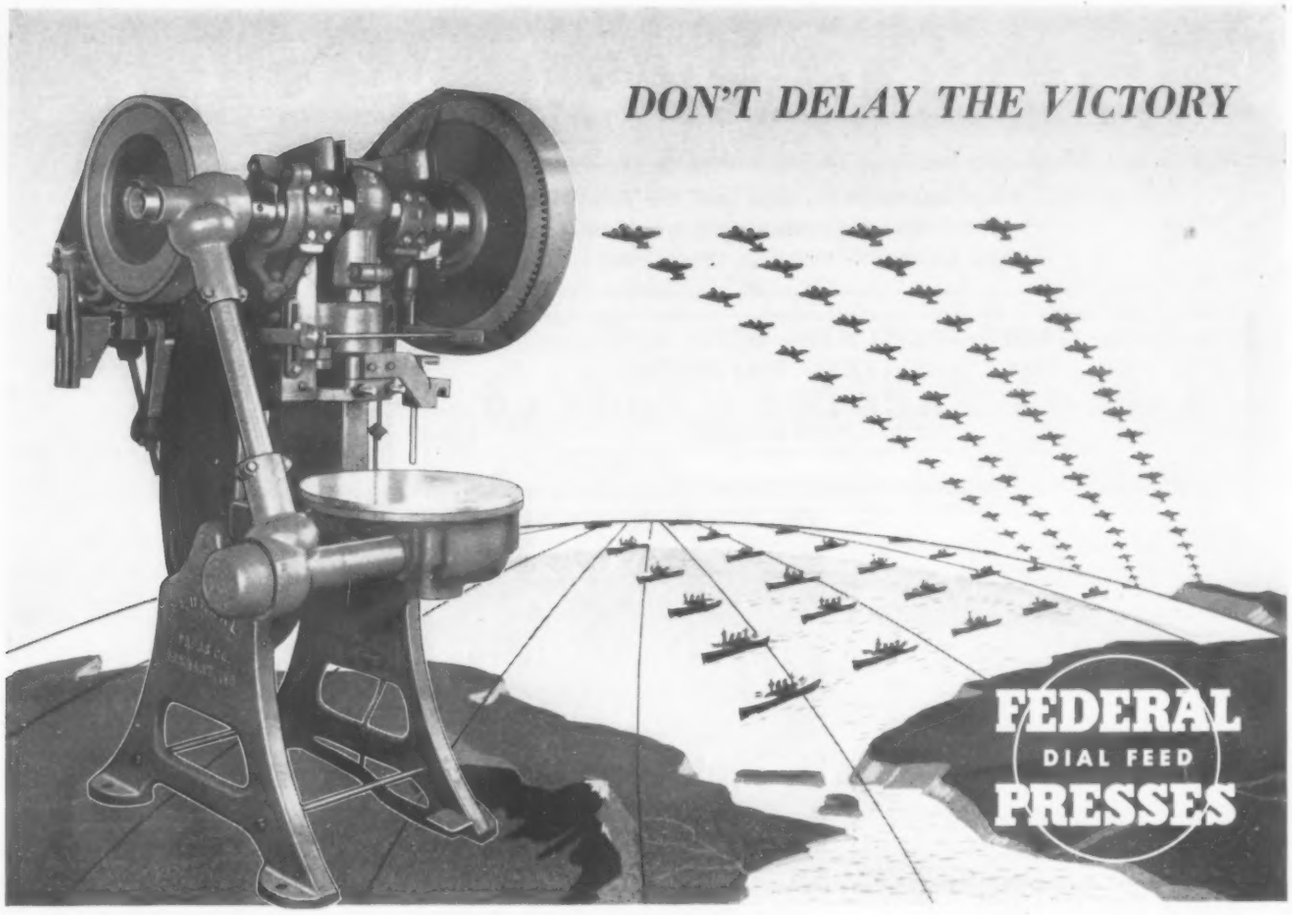
WITH MORE THAN 150 ENGINEERS FOR

PROCESS & METHODS
TOOL DESIGN
MACHINE DESIGN
PRODUCT DESIGN
ENGINEERING COUNSEL

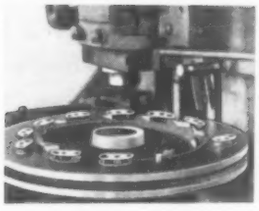
OUR REPRESENTATIVE WILL GLADLY CALL AT YOUR REQUEST

GEORGE SCHER ENGINEERING CO.

115 FIRST ST. NEWARK, N. J.



Speed PRESS ROOM OPERATIONS WITH FEDERAL DIAL FEEDS



Don't delay victory by using old, incompetent press equipment in your plant! Now you can *speed up* many primary and secondary operations from *three to six times*—and even more—by using Federal precision-built presses with multiple dial feeds! Check all these important features:

Positive indexing and locking mechanism smooths out action of the exclusive Federal dial—permitting unusually rapid production with exceptional accuracy and safety to the operator. Easily indexed to any part of the crankshaft revolution from 90° to 180°, giving long or short dwell of the dial. Cannot skip or coast by stations. All moving parts are enclosed. Automatic loading and ejector mechanisms can also be furnished if desired. And dial feeds are available in eight sizes of Federal Presses.

Speed up victory! Write for latest illustrated literature on the complete line of Federal Presses. There is no cost or obligation.

THE FEDERAL PRESS CO.

609 Division Street, Elkhart, Indiana.

A FEW OF THE COMPANIES WHICH ARE SPEEDING PRODUCTION WITH FEDERAL DIAL FEED PRESSES

General Electric Co. Wheeling Steel Co. B. F. Goodrich Co.
Bendix Products Co. General Tire & Rubber Co.
Ohio Rubber Co. C. G. Conn, Ltd. P. R. Mallory Co.
Fulton Sylphon Co. Barnes Gibson Raymond Co.
Firestone Tire and Rubber Co.

MANY FEDERAL MODELS

Federal Open-Back, Inclinable Presses are available in nine sizes, with capacities ranging from six to 80 tons—either flywheel or geared type. They represent the culmination of Federal's 40 years' intensive experience in press building.

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

GAGES—PUNCHES—DIES—ETC.
HEAT TREATING FACILITIES
BARTON MACHINE & TOOL CO.
PRECISION TOOL MAKERS
14 Taft Street — Pawtucket, R. I.

Designers and Builders of Jigs, Fixtures and Small Tools.
Also Manufacturers of Automatic Turret Head for 10 inch Lathes.
Complete Details upon Request
GAS MODEL RESEARCH CO.
21 Market St. — Rockville, Conn.

PUNCHINGS
STAMPINGS
ASSEMBLIES

Quick action on your problem! Use our manufacturing facilities as your branch factory. Well-equipped for small and medium-sized work. Investigate time-saving possibilities *today!* Send prints or samples.

M & M MANUFACTURING CORP.
FORTVILLE, INDIANA

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
1103 E. 23rd St. — INDIANAPOLIS, IND.

DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

SPUR GEAR AND SPROCKET CUTTING

Have three automatic machines available—range 1" to 6' diameter.

OHMSTEDE MACHINE WORKS
897-899 N. Main St. — Beaumont, Texas

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place — New York City
36 years experience in metal fabrication.

DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service
LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria — Virginia

WORK WANTED FOR

Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.

HAIDA ENGINEERING CO.
34-11 Vernon Blvd. Long Island City, N. Y.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work —they use our patterns every day.
GENERAL PATTERN WORKS
2233 Buck Street — Cincinnati, Ohio

• **QUALITY** •
SCREW MACHINE PRODUCTS
• ● •
WALTHAM SCREW COMPANY
WALTHAM • MASS.

MACHINE SHOP WANTS DEFENSE WORK

Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.

STEPHEN J. LEWIS ENGINEERING CO.
218 Border St. Triangle 5-3046 Brooklyn, N. Y.

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

DOES IT WORK?

Is the Contract Work Section helping *American Machinist's* subscribers and readers find outside help when they need it? Does advertising in this section really do its job?

If you have idle equipment to put to work, you will want the answers to these questions. You can get them quickly by addressing CONTRACT WORK DEPARTMENT, *American Machinist*, 330 West 42d St., New York, N. Y.

KIRK & BLUM
WELDED MACHINE BASES, PEDESTALS and FRAMES
LATHE PANS
GEAR and BELT GUARDS
Pressed Steel Louver Panels and Cover Plates
THE KIRK & BLUM MFG. CO.
2823 Spring Grove Ave. Cincinnati, Ohio

COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
AGERSTRAND CORPORATION
Muskegon, Michigan

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

MACHINISTS AND ENGINEERS
FIDELITY
MACHINE COMPANY
3908-18 Frankford Ave. Phila., Pa.
Jefferson 7600-1-2

STAMPINGS AND ASSEMBLIES

"GREATER SAVINGS WITH GREIST"

We can make short or long runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. We are also fully equipped to make

SCREW MACHINE PRODUCTS
TOOLS, DIES, JIGS, FIXTURES

Quality work by skilled mechanics is assured. Send your blueprints or samples today!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy
SPECIAL MACHINERY
CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

SUBCONTRACTS WANTED

— Parts and Pieces — Complete Assemblies —

34 Automatic Screw Machines—Secondary Equipment: Milling, Drilling, Tapping, Threading—39 Punch Presses—Tool Room (well equipped) —Finishing: Parkerizing, Electroplating, Lacquering, Tumbling, Sand .Blasting, Polishing, Buffing.

Write for Complete Facilities List

NATIONAL BRASS CO. GRAND RAPIDS MICHIGAN

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO.
HOCKESSIN DELAWARE

SPECIAL ENGINEERING WORK

ON A CONTRACT BASIS . . .
exactly to your specifications . . .

A complete and efficient service for the manufacture of machines and parts, special tools and fixtures, etc., is available to you in our modern, fully-equipped shop. We also offer cam milling facilities that will fit your requirements. You are guaranteed quality work at a reasonable cost.

Send your blueprints or samples *today* for prompt quotations at no obligation.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE CO., Bridgeport, Conn.

BRAZING HYDROGEN ELECTRIC FURNACE PROCESS
MODERN CONTINUOUS
HIGH PRODUCTION EQUIPMENT
ALSO—BRIGHT ANNEALING
THE QUEEN CITY STEEL TREATING CO.
CINCINNATI, OHIO

Need steel balls for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.
ABBOTT BEARING BALLS

THE NORLIPP COMPANY

Engineers . . . Manufacturers

Sub-contract facilities for die castings and metal stampings
556 West Congress Street Chicago, Illinois

GEST ENGINEERING & EQUIPMENT CO.

Ordnance and Defense Plant Equipment
Industrial Engineers
Jigs, Fixtures, Gages and Special Mach.
31 East, Georgia St. Indianapolis, Ind.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., September 8th will appear in the issue of September 17th, subject to limitations of space available

WANTED

Experienced man to take full charge of a Tool, Cutter and Gage Shop.

P-282, American Machinist
330 W. 42 St., New York City

WANTED
GAGE MAKER

Man wanted experienced in every detail in the manufacture of "Thread Gages" to eventually assume full charge of this department; state experience and salary. Connecticut location. New York interview can be arranged.

P-311, American Machinist
330 West 42nd St., New York City

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

TOOL DESIGNERS—Routers—Production Control Men. Must have machine shop background and complete knowledge of modern machine tools. Experience on medium-heavy machinery valuable. P-287, American Machinist, 330 W. 42nd St., New York, N. Y.

A COMPETENT MACHINE shop general foreman by plant located in an industrial city in East Tennessee and doing general jobbing and building special machinery. Plant operates own foundry, machine shop, and pattern shop. Offers splendid opportunity for rapid advancement. None but a man of highest qualifications need apply. P-302, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

INDIANA UNIVERSITY Mechanic, to take charge of shop in Medical School, for maintenance of precision instruments. Adequate salary, permanent, State qualifications. Apply, Personnel Office, Indiana University; Bloomington, Indiana.

WANTED—MACHINIST FOREMAN. To establish small plant for producing screw machine parts. Must have knowledge of tooling and set-ups on single and multiple spindle automatic screw machines. Plant located eastern Pennsylvania. Apply P-313, American Machinist, 330 W. 42nd St., New York, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc. 266 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

EXECUTIVE with twenty-five years experience as Chief Engineer, Superintendent and Works Manager. Well versed on modern methods and equipment. Available Sept. 1st. PW-308, American Machinist, 330 W. 42nd St., New York, N. Y.

FACTORY MANAGER or superintendent Automatic Screw Machine and small to medium precision parts, thirty years experience all phases of above types of work. Available October 1st. Salary open. PW-314, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

Capable Works Manager or General Supt.

available Sept. 15. 30 years exp. in mfgr. of large and small machinery and mach. parts. Know Costs control, Modern Productive Methods and Job Analysis. Peak production guaranteed. Amer. citizen, age: 48. Location anywhere. Min. sal. $10,000.

PW-316, American Machinist
330 West 42nd St., New York City

WANTED
MECHANICAL DESIGNERS AND DETAILERS

Two machine designers and several detailers for permanent positions in an essential industry. Machine tool or automatic machinery experience desirable. Send complete outline of education, experience, age, martial status and salary desired in first letter. Location Pennsylvania. Address

P-312, American Machinist
330 W. 42nd St., New York City

Assistant General Foreman wanted

for scraping, fitting, assembling departments. Machine Tool Plant. Preferably under 45 years of age. Must be capable of directing work, know how to handle men, and be qualified to introduce improvements. Location New Jersey. State Qualifications, Nationality, salary expected in first letter.

P-317, American Machinist
330 West 42nd St., New York City

POSITIONS WANTED

INDUSTRIAL MECHANICAL ENGINEER and Construction Superintendent. College graduate, twenty years experience. Nine years Civil Engineering design of roads, railroads, waterworks and docks. Five and one half years Construction Superintendent of roads, bridges and buildings. Five and one half years mechanical design heavy industrial buildings, power plants, machines and maintenance equipment. Age 47. Licensed Civil (Ohio). Position desired —Industrial Plant Chief Engineer or Chief Works Engineer or Construction Project Engineer. Available August 20th. Free to travel. Write P.O. Box 923, Canton, Ohio, for complete experience record.

GENERAL MANAGER — Mature, Profit-minded, Dependable. Has successfully managed four companies—two taken out of the red. Available for service shortly with medium size company requiring reliable directing ability in management, sales, finance and production. Excellent experience machinery, tool, foundry and related lines. PW-318, American Machinist, 330 W. 42nd St., New York, N. Y.

WORK WANTED

CHIEF INDUSTRIAL ENGINEER — Fifteen years experience Diesel Engines, Gas Engines, Machine Tools. Can bring staff. Plant Layout, Time and Motion Study, Budgets, Production Control, Job Evaluation, Foremanship training, Cost Control Plans. Age 36, married, two children. Employed present non-defense. WW-315, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

PATENT ATTORNEY, CONSULTING ENG'R. Over twenty years engineering experience with patents. Confidential Personal Service. David Manly Heller, 134 North LaSalle, Chicago.

FOR SALE

DISTANCE THERMOMETER 100° to 212° F. 12" lead, 2" round dial, radium hand and graduation, new complete $3.95. Revolution tachometer, 4" dial, aircraft type, accuracy within 20 revs. range 0-2400, RPM, brand new $15.00. Air Transport Equipment, Inc., Garden City, N. Y.

PROFESSIONAL SERVICES

MORRIS AND VAN WORMER
Est. 1924
Industrial Engineers
WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
25 Broad Street New York City

WAR CASUALTY FOR SALE

A group of substantial steel buildings, under one roof, enclosing an area of approximately 132,000 square feet—siding corrugated steel—roofing corrugated asbestos—traveling cranes. Power plant may be included. Approximately one mile of railroad track through and around buildings. Three railroad trunk lines. Adjacent to deep water. Buildings may remain on present site. For details address P.O. Box 1121, Wilmington, Delaware, or telephone Wilmington 7104, extension A.

POSTWAR PRODUCTS
WANTED!

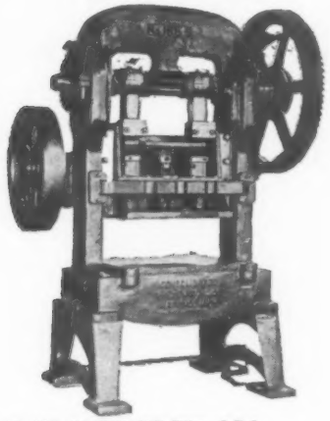
Long established, responsible manufacturing and sales organization seeks postwar products. Machinery, equipment or consumer goods. Confidential.

P. O. Box 502
Northwestern Station
DETROIT, MICHIGAN

Wanted Advertising—see page 200

FALK *for* DEPENDABILITY

PUNCH PRESSES



No. 1S, 18C, 19, 19C, 20B Bliss, O.B.I.
No. 19 Truesdale OBI.
No. 4 Adriance OBI.
No. 46 MICHIGAN OBI
No. 4 V & O—OBI.
No. 73½ BLISS S.S. Plain flywheel.
No 4 Bliss Back Flywheel Geared.
No. 2 BLISS Back Flywheel Plain, (6).
No. 1—Bliss Back Flywheel Plain.
No. 3R—Marquette Geared, Motor Dr.
No. 15N BLISS, arr. Geared, Motor dr. (2).
No. 41 TOLEDO HORN PRESS, arr. Motor dr.
No 6 Waterbury Backed Geared, Open Back.
No. 25N BLISS Geared, Motor dr.; (3).
No. 1 BLISS S.S. Toggle Press.

25 Ton Henry & Wright High Speed Press, dble. roll
No. 103S BLISS GANG DIE PRESS; Roll Feed.
No 4½ BLISS three column Forging Press with Taper
6 Ton General Flexible Press.
12 Ton Fox Flexible Press.
400 lb. Chambersburg board Drop Hammer.
1500 lb. Chambersburg Steam Hammer, single leg.
50 lb. DuPont Blacksmith Hammer.
15 lb. Bradley upright Strap Hammer.
No. 30 BLISS ARCH PRESS, Plain.
No. 25 NIAGARA ARCH PRESS, Plain.
No. 71 Waterbury Coining Press 25 Tons.
No. 93D TOLEDO DBLE. CRANK GEARED S.S. PRESS, Welded Frame.
No. 75 Toledo Open Back Plain Flywheel Press.
No. 16 Bliss Horn Press, 3" stroke, Motor Driven.
No. 2 Niagara OBI; No. 0 V & O (3).
No. 3 American Can Co. OBI.
No. 53 Perkins Sprue Cutter.
No. 5 Middleditch Sprue Cutter.
No. 1—100 lb. Standard Automatic Drop Hammer.
No. 702—BLISS TRIMMING PRESSES (2) Flat.
No. 4 Waterbury open back, rigid bed, plain.
520 Ton Southwark Hydraulic with Laurie Pump.
SHERIDAN EMBOSSING PRESS, 24x36.
#7H Cleveland HORN PRESS back geared, 8" stroke with screw elevating cable. 42 tons.
#39H Bliss HORN PRESS.
#4 Bliss, double crank GEARED PRESS. 4" stroke, bed 32x28.

SHAPERS & SLOTTERS

15" HENDEY, Friction Drive (5), $450 ea.
20" CINCINNATI, Geared Crank, complete.
24" Stockbridge, Geared, Crank, Heavy, Cone dr.
20"x20"x24" N-B-P SHAPER-PLANER, Motor Dr.
12" New Haven Slotter; 32" Rotary Table.
7" Rhodes combination Shaper and Slotter, belt dr.

DRILL PRESSES—HIGH SPEED, BALL BEARING; SLIDING HEAD; SCREW EL. TABLES

4-Spindle Foot-Burt High Speed Ball Bearing with power feed to each spindle; automatic quick return, tight and loose pulley drive; 8" overhand No. 2 Morse Taper; table working surf. 14"x48".
1-Spindle Avey No. 3, 12" Overhang, No. 3 M.T. with Power feed; Ball Bearing.
1-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. with Power Feed; Ball Bearing.
2-Spindle Avey No. 2, 8" overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
3-Spindle Avey No. 2, 8" Overhang, No. 2 M.T. Plain Hand Feed; Ball Bearing.
2-Spindle Leland Gifford No. 2 M.T. 10" Overhang. Power feed to one Spindle.
2-Spindle KERN No. 2 M.T. 8" Overhang.
2-Sp. Henry & Wright, 8" Overhang, No. 2 M.T.
1-Sp. EDLUND No. 2B, 8" Overhang. No. 2 M.T.
1-SPINDLE ALLEN No. 2 M.T. 8" Overhang.
1-Spindle FOSDICK with TAPPING MECHANISM On SPINDLE No. 2 M.T. 8" Overhang.

DISC GRINDERS

Gardner No. 8—40" disc, 30" Ring Wheel, B.B. Belt Dr.
Gardner No. 4—20" Disc., 16" Ring Wheel, B.B. Belt Dr.
Badger No. 2—16" Disc, Double End, Univ. Tables, Belt
Gardner No. 1—double end Disc, 12", B.B. belt dr.
GARDNER No. 14, Ball Bearing, double opposed, 20" discs.

20"x120" Landis Plain Cylindrical Grinder Self Cont'd, Motor drive, Serial 8034.

GRINDERS—Cylindrical

20"x120" LANDIS Self-Contained, Motor dr.
12x36" CINCINNATI Plain, Arr. Motor Dr.

AUTOMATIC CHUCKING MACHINES

2—No. 24 New Britain type 5 spindle.
1—No. 23 New Britain type 5 spindle.
1—J&L, HARTNESS AUTOMATIC CHUCKING LATHE; motor driven, 6"x12"

BROACHING MACHINE

Cincinnati SURFACE BROACHING MACHINE, model #5-54 duplex. New in 1937.

PUNCH & SHEARS

WICKES COMBINATION PUNCH AND SHEAR; MOTOR DRIVEN; 1¼" thru 1" Plate; Punching end 48" throat; Shearing end 36" throat; Continuous 6"x1" Plate.
LONG & ALLSTATER No. 2—24" Throat, arr. motor dr. Capacity 1" thru 1".
Niagara 36" foot Shear, 16 ga.
Kutscheid all steel 36"x16 ga. Foot Shear.
Pexto 48"x16 gt. Foot Shear.
Pittsburgh 36"x¾" Plate Shear, no holddown.
UNITED ENGINEERING Plate Shear 42"x3/16 no holddown.
No. 216D NIAGARA RING AND CIRCLE SHEAR, Motor Dr.
No. 236 PEXTO CIRCLE SHEAR, SPD; 16 ga.
No. 132 BLISS 14 ga., 12" throat, Slitter.
No. 232 Bliss 12 ga., 18" throat, Slitter.
12'x¾" and 6'x⅜" STAMCO MILL PACK SHEAR.
BLISS 24"x16 ga. POWER SHEAR—Perfect for Tin Plate.

COILING MACHINES

No. 1 and No. 2 SLEEPER & HARTLEY BX CABLE COILING MACHINES ⅝ and ½" cap. Last used for Speedometer cable. Complete.

KEY SEATER

No. 3½ BAKER 72"x3" Cap. immediate delivery.

HAND SCREW MACHINE

#2 BARDONS & OLIVER, Geared Friction Head, Power feed to Turret, 1" Cap. fitted with complete automatic chuck and air cylinder.

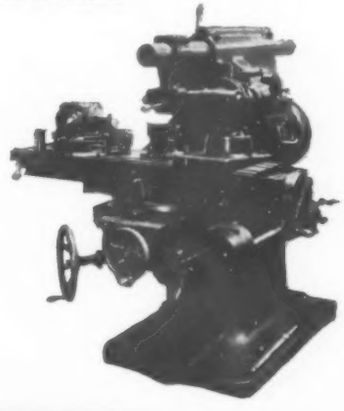
INTERNAL GRINDER

GREENFIELD No. 12, HYDRAULIC FEED, Motor Drive; Cap. swings 15" Grinds automatically ¾" to 5" dia.; 4" Deep; New in 1928.

MILLING MACHINES

No. 1 Cleveland, Motor Drive—$1,750.00.
Coolant Pump, Motor $95.00 Extra.
cap. 18" longit. feed
16" Vertical travel
8½" cross travel
table working surface 8"x32"

No. 12 Pratt & Whitney Lincoln Production Miller.
No. 2 Pratt & Whitney Lincoln Production Mill.
1—3-H LeBlond Plain Miller, au. motor drive. Power feed all direction.

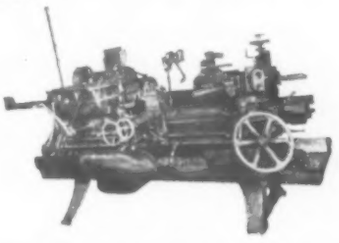


LATHES

42"x25' PUTNAM triple geared, 17'6" centers; Plain change gear, screw cutting.
36"x18' PRENTICE Lathe 9' Centers—Pl. chge. screw cutting, chuck and standard equipment.
22"x16' REED light Pattern, Pl. Change gear; 11" Centers, $750.
19x8 LEBLOND Production Turning Lathe
1—16"x8' American C.G. Lathe—au. M.D.
11"x4½' DAVIS pl. change screw cutting engine lathe; complete; $225.
10"x4' LOGAN (NEW) Lathes, Ball Bearing Spindle; ½" Collet capacity; arranged for motor drive; power cross feed; $225, f.o.b. factory; priority certificate required; shipment from stock.
7"x36" PRECISION BENCH LATHES — Hardinge, Sloan & Chase and others.
8"x108" FITCHBURG LO-SWING LATHE; SPD.
18"x12' HAMILTON pl. Change, Cone dr. chuck
11"x4' PRATT & WHITNEY TOOLMAKERS LATHE, Taper att.
16"x6' SOUTH BEND pl. Chge., Screw Cutting Engine Lathes (2).

TURRET LATHE

JONES & LAMSON 3x36 Double Spindle Very fine condition.



5" Bar BETTS Knee Type Horizontal Boring Mill, M.D.

COLD HEADERS
#22 Waterbury Farrell Cold Headers Dble stroke Solid Die also #11.

RADIAL DRILLS

DRESES 3' Arm, Plain Radial, Motorized; REBUILT —READY TO GO.
DRESES 4' Arm, Plain Radial, cone dr.

DIE CASTING MACHINES
3—MADISON-KIPP late model, 10"x12", 12"x14", 12"x16".

GEAR CUTTERS

No. 2 WHITON SPUR GEAR CUTTER, Auto.
36" Gould & Eberhart, "Victoria Model" perfect Cond.
48" Gould & EBERHART, Motor Driven; Complete; Perfect Cond.
No. 36B Gould & Eberhart Spur and Bevel Gear Cutter, Motor Dr.

HAMMOND 10 H.P. BUFFERS—8 months old. Motors in base, 3-60-220/440.

NEW LINES—WE SELL DREIS & KRUMP "CHICAGO" PRESS BRAKES AND BENDING BRAKES; STREINE POWER SQUARING SHEARS; BUFFALO DRILLS AND IRON WORKERS; CLEVELAND MILLING MACHINES; INDEX UNIVERSAL VERTICAL MILLERS; TROYKE ROTARY TABLES; L-W LATHE CHUCKS; INDEX HEADS; MAGNETIC CHUCKS AND HACK SAWS; VISES; OSWEGO MACHINISTS BENCH VISES; B-LINE MOTORS; VALLEY ELECTRIC GRINDERS; INQUIRIES INVITED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

EASTERN OFFERS FROM STOCK

GEAR CUTTERS & HOBBERS

No. 1 Whiton—26" Full Universal Spur & Bevel
18" Gleason Straight Bevel Gear Generator
30" Brainerd Gear Cutter
Gleason Spiral Bevel Gear Rougher
No. 3-26", 3-36" 3 Heavy, 4-36", 4-48", 6-60", 6-72" Brown & Sharpe Gear Cutters
No. 5 Lees-Bradner 14" Gear Generator
No. 12 Barber-Colman Gear Hobber
Cross Gear Tooth Rounder

SHEET METAL MACHINERY

No. 230 Robinson Square Shear
8' Niagara 18 ga. Foot Power Square Shear
10" Bertsch 3/16" Square Shear
10" Newton 3/16" Square Shear
No. 2 Campbell Nibbler, m.d.
No. 3 Gray Sheet Metal Cutter
No. 10A Quickwork Double Seamer
7' Robinson Hand Brake
12' Dress & Krump Hand Brake
McCabe Pneumatic Flanger
8', 10' Niles Flangers
No. 0-15 Unishear, m.d.
No. 34 Lennox Rotary Bevel Shear
No. 258 2x14 Quickwork Rotary Shear, ¼" cap. 30" throat
Niagara Circle Shear, belt
Southwark Rotary Metal Cutter, ⅜" cap. 36" throat

SLOTTERS

10" Niles
18" Niles-Bement-Pond
84" Newton, m.d.

MISCELLANEOUS

Gisholt Precision Balancing Machine, m.d.
Norton Running Balance Indicating Machine, m.d.
No. 5 Williams & White Bulldozer
Sprague Electric Dynamometer, 250 H.P. 250 volt
17x21" Lentz Poppet Valve Steam Engine, direct connected to Allis-Chalmers Generator, 200 KVA, 200 RPM, A.C. 240 v, 60 c.
No. 22 Williams & White Eye Bender, m.d.
No. 2 Cochran-Bly Filing Machine
No. 1 Fischer Oil Groover
Production Polishing Machine
Wagner Saw Sharpener
No. 11, 118 Cochran-Bly Saw Sharpeners
Leighton Straightening Machines, new
¼", ⅜" Shuster Wire Straighteners

TOOL & CUTTER GRINDERS

Yankee Twist Drill, 1¼" cap., belt
Gisholt Universal Tool, belt
Gleason Cutter, belt
Gould & Eberhardt Gear Cutter, belt
Modern Chaser, belt
Gorton Tool, m.d., late type

HAMMERS

60 lb. Bradley Rubber Cushioned Helve, belt
100 lb. Little Giant, belt
100 lb. Little Giant, m.d.
800 lb. Bement Single Frame Steam
1000 lb. Bement-Miles Single Frame Steam
1100 lb. Niles-Bement-Pond Single Frame Steam
2000 lb. Niles-Bement-Pond Single Frame Steam
2500 lb. Bement-Miles Single Frame Steam
Pettengell Bumping, belt

KEYSEATERS

No. 0 Mitts & Merrill
No. 1 Baker
No. 2 Morton
Morton Keyway Cutter & Slotter, 24" stroke
No. 4 Mitts & Merrill

ENGINE LATHES

16"x8' Champion
18"x8' American, taper, relieving attach.
18"x12' Barker
18" raised to 28"x10' Reed
18"x16' Reed
20"x8' Fay Scott
21"x12' Bradford
22"x12' Niles
22"x16' centers (22' bed) American 100 H.P. Input Super Lathe, with d.c. electrical equipment, geared head, very late type, weight 65,000 lbs.
22"x18' Niles
24"x8'6" Bridgeford
24"x11' Chard
24"x12' Reed
24"x16' Schumacher-Boyce
26"x16' Betts-Bridgeford, taper
27"x16' Lodge & Shipley
30"x14' Hamilton
24"x28' LeBlond

Many other machines in stock. Send us your inquiries

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1004 TENNESSEE AVE.
CINCINNATI, OHIO

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Every machine listed on this page is in our warehouse at press time.

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KEMPSMITH Slotting Attachment for 4" bar
No. 2 CINCINNATI Vertical Attachment—can also be used on No. 3-S for 4½" bar
No. 3 CINC. Vert. Hd., 4½" bar
No. 4 CINCINNATI Vertical Hd., for rectangular overarm
No. 5 CINCINNATI Vertical Hd., screw nose, 5¼" bar
No. 4 BROWN-SHARPE Rack Cutters—old type machine
Slotting Attachment for No. 1½ K&T Miller
Vertical Head for No. 1½ K&T Miller
No. 3 K&T Vertical Heads for No. 3-B Machines
No. 2 K&T Vertical Head for Screw Nose
No. 3 KEMPSMITH Vert. Hds.
CINCINNATI Univ. Spiral Milling Machine att., 4½" bar
CINCINNATI Univ. Spiral Milling Machine att., 4¼" bar
CINCINNATI High Speed Univ. Vertical Head 4¼" bar
12" and 14" CINCINNATI Univ. Dividing Heads
12" K&T Plain Dividing Hd.

2" B&K Pipe Threader, Landis Head
4" & 6" B&K Pipe Threaders, M.D.
4" LANDIS Pipe Threader
10" STANDARD Pipe Threader SPD
14" EC. & B. Pipe Threader
4" & 16" BAKER Tapping Machine
#8 GATERMAN ⅛ to ¾ Tapper
#3 BEMENT Two Spindle Gang Drill
24" GLEASON Gear Former
48" TINDEL-MORRIS Crankshaft Lathe
1½" AJAX Bolt Header
2" ACME Upsetter
18'x12-Ga. Steel Press Brake
2" STOVER Pipe Bender

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WHITON No. 15 Auto. Gear Cutter
FELLOWS No. 6 Gear Shaper
INGLE 12" Gear Tooth Rounders
GLEASON 37" Bevel Gear Planer
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 6"-11"-18" Bevel Gear Generators
LEES BRADNER #5A Gear Generator
LANDIS 3½" Internal Hydraulic Race Grinder
LANDIS 16"x36" Plain Cyl. Grinder—M.D.
NORTON 14"x50" Plain Grinder—M. D.
HEALD No. 60 Internal Grinder
NORTON 16"x50" Crankshaft Grinder—M.D.
GARDNER No. 6 Dble. End BB Disc Grinder
P. & W. 6"x132" Thread Miller
AUTOMATIC MACHINE CO. 12x4' Threading Lathe
BRIDGEFORD 27"x10' Boring Lathe

BLANCHARD No. 16A Automatic Surface Grinder—Hand feed

P. & W. No. 12 Multi-Spindle Drill
NATCO C-13 Hyd. Multiple Spindle Drill
NATCO C-11C Multiple Spindle Drill
BLISS No. 31 Power Press
ESPEN LUCAS No. 138 Cold Saw—Cap. 12" Rd.
NEWTON No. 197 & No. 200 Cold Saws
COCHRANE & BLY No. 5 Cold Saw
COULTER 2 spindle Diamond Borer—M.D.
LANDIS 4" Single Head Bolt Cutter
GRAY 30"x30"x8' Planer—2 heads on cross rail—M.D.
ACME 1" All Steel Upsetter
AJAX 3" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
KELLER E3 Auto. Profiler (Die Sinker)
GISHOLT Precision Balancing Machine

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MOREY
MACHINERY CO., Inc.
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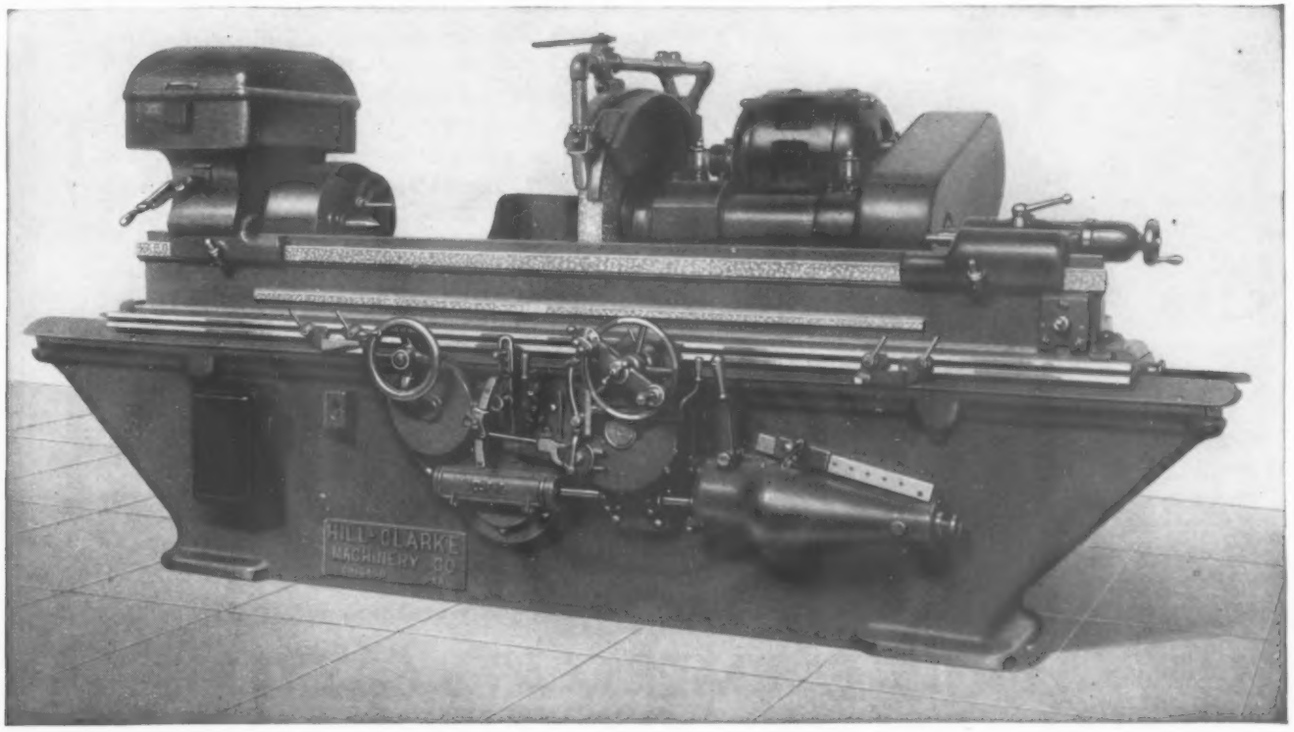

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give you a finish within a few micro-inches even when using standard grain free-cutting wheels. Contributing to this achievement is a patented multiple V-belt drive from a constant speed motor to the work spindle.

Throughout the machines there are refinements in design, fitting of components, minimized vibration which make possible extreme accuracy in all grinding operations. An accurately fitted wheel slide with cross feed screw mounted in ball bearings provides sensitive wheel control essential to duplicate work within close limits. For complete information, write for our illustrated catalog "Super Grinding."

SIZES

10 x 36	10 x 72	14 x 50	16 x 72
10 x 50	14 x 36	14 x 72	18-30 x 96

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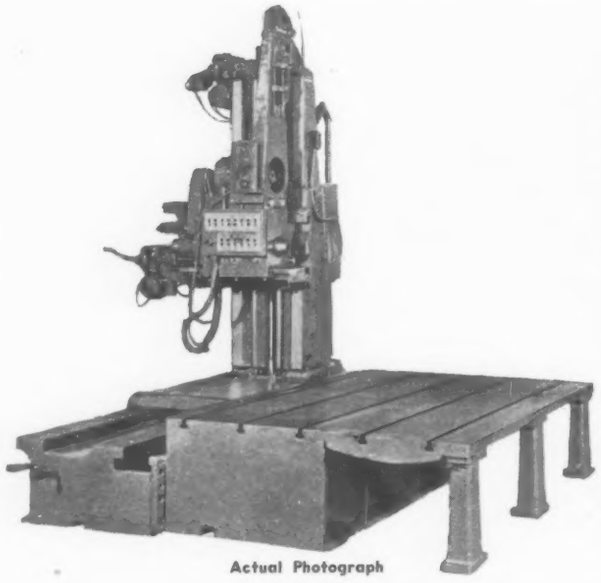
BG-724 KELLER DIE SINKER



Actual Photograph

Die capacity—face 88" x 48"
depth with standard table 30"
depth with extension table 58"
Head vertical travel 48"; horizontal travel 72"
Spindle head travel 18"
Maximum reach of spindle 24"
Center distance between cutter and spindle tracer max. 50½"; min. 35½"
Working surface standard table 88" x 30"
Working surface extension table 88" x 58"
Equipped with panel board and switch boxes
Vertical feed drive motor—¾ HP, 110 volts, vary RPM, Ohio D. C.
Cutter spindle motor—2 HP. 115 volts, Gen. Elec. D.C. motor
Column drive motor—⅝ HP. intermittent duty. 115 volts, G.E. D.C.
Horizontal traverse motor — ⅛ HP. 115 volts. Ohio D.C.
Weight approx. 16,500#

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Bullard Vertical Boring Mill 51" and 42"
Colburn Vertical Boring Mill 42"

PLANERS:
Betts 60x60x24, 2 heads on rail
Sellers 72x72x20, 4 heads

MILLING MACHINES:
#13 Garvin Plain
#3 Hendey Universal
#5B Becker Vertical Milling Machine

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3x36 Jones & Lamson, geared head
2—#3A Warner & Swasey
2 x 24 Jones & Lamson, geared head
Libby 7½" hollow spindle chucking lathe

GRINDERS:
2—#3 Modern Cylindrical Grinders
#12 Brown & Sharpe Tool & Cutter Grinder
#2 Walker Tool & Cutter Grinder
#52 Hydraulic Internal Grinder
14" Pratt & Whitney Ball Bearing Vertical Grinder
#65 Heald internal

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24" Gould & Eberhardt
24" Cincinnati
16" Gould & Eberhardt
16" Steptoe

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32"x16' Putnam
28x12 Schumacher & Boyse
16x6 Hendey
16x6 Flather

PRESSES:
Bliss #4
Bliss #0

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36" Putnam
18" American Tool Works
Combination Drilling, Milling & Boring Machine
4' Universal Radial Drill

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Rebuilding Plant
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AUTOMATICS, 1¼" Cleveland Model B; #34 New Britain Chucker
GRINDERS, #2 Churchill Internal, can grind 30" deep, dist. center of spin, to top of table 18"; 30" x 240" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.
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KEYSEATERS—#3 Baker, 20" stroke x 3" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M.
MILLING MACHINES—#3 Lees Bradner Thread Miller; #3 P & W die sinker; #6 Jackson Die Sinker or Vertical Miller.
PLANERS—72" x 72" x 18' Cincinnati, 2 heads, 72" x 60" x 14' Cincinnati, 3 hds. D.C. reversing M.D. 60"x48"x14' Bertram Openside, 3 hds., DC Reversing M.D.; 26" x 8' Gray, 1 head.

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30 Church Street New York, N. Y.

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12" x 96" LANDIS Plain Cylindrical Grinder Belt Drive machine, with countershaft; also headstock and tailstock.
Automatic Feed machine, including wheel-feed adjusting device.
ALSO MANY OTHER TOOLS
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Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Prentice Pl. Cone Drive Radial Drill
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Gisholt Univ. Tool Grinder
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

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20"x144" Landis, Plain cyl. will motorize
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12"x36" Pratt & Whitney, Surface
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2—Bryant #15 Internal
#3 Bryant Internal, motor dr.

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136′, 8″x8″ **Chicago Pneumatic Tool Co.**, type N8B.
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550′, **National** 3-cylinder vertical
620′, 14″x8¾″x10″ **Sullivan**, class WJ3 angle compound
706′ 17″x9¾″x12″ **Sullivan**, class WJ3 angle compound
868′ 17″x10″x12″ **Chicago Pneumatic Tool Co.**, type OCB
1400′, 20″x12″x14″ **Sullivan**, class WJB

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Nos. 5, 6 and 29 **Williams & White**

BROACHES

No. 1 **LaPointe**, screw type
No. 2 **Standard** screw type broaching press
No. 3 **LaPointe of Hudson**, screw type
No. 3 **J. N. LaPointe** double screw type
No. 3 **American** high speed, rack type

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20″ **Excelsior** plain hand feed
20″ **Silver** plain hand feed
20″ **W. F. & J. Barnes** plain hand feed
21″ **Superior** plain hand or back geared power feed, tapping attachment
21″ **Cincinnati** plain hand feed
21″ **Cincinnati** sliding head
21″ **Cincinnati** direct geared mfg.
22″ **Aurora** sliding head
22″ **Barnes** sliding head, hand feed
22⅛″ **W. F. & J. Barnes** stationary head, back gears, power feed
22⅛″ **Mechanics plain** hand feed
24″ **Cincinnati Bickford** sliding head, back geared power feed
24″ **Cincinnati Drill Co.**, sliding head, power feed
25″ **W. F. & J. Barnes** stationary head, back gears, power feed
25″ **Superior** sliding head, back geared, power feed
26″ **W. F. & J. Barnes** sliding head, back geared, power feed
26″ **Bickford**, sliding head, back geared, power feed
26″ **Hoefer** sliding head, back gears, power feed tapping attachment
28″ **Aurora**, sliding sliding head, back gears, power feed
22½″ **W. F. & John Barns**, 4 spdl. hy. dy.
24″ **Barnes Drill Co.**, hy. dy. camel back

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Nos. 15½, 15½F and 16 Foote Burt for Multiple heads
Garvin, Nos. 0 and 00S, double end drilling and centering
Natco one and two-way lead screw tappers
Baker hydraulic, double end drill.
5 spindle **Detroit** automatic with fixtures
3 way **Foote Burt** for multiple heads
Avey motor driven unit heads, No. 2, ⅝″ capacity
No. 3 **Milholland** two way drills, motor drive
4″x12″ & 4″x72″ **Sundstrand** double end drilling and centering
1′ **Cleveland**, Model J, double end drilling, threading, pointing or turning
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21″x32″x21″ **Surface Combustion Co.** heat treating
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GEAR CUTTERS

No. 18H **Gould & Eberhardt** universal gear hobber
8″x10″No. 1 **Lees Bradner** production hobber
14″x8″ No. 5A **Lees Bradner** universal hobbers
26″x8″ No. 3 **Brown & Sharpe** auto spur.
36″x6″ **Gould & Eberhardt** spur gear cutter
48″x10″ No. 4 **Brown & Sharpe** automatic spur
15″ **Gleason** bevel gear quencher
Gleason circular finishing cutters, without blades
National Tool Co. (Cleveland) Model B gear and gear shaper cutter checking machine
Lipe gear tooth chamfering machine, double spindle
No. 3 **Barber Colman** gear hobber
18″ **Gleason** bevel gear generator

ROLLS

No. 1A **Ajax** taper forging, motor drive.
54″ **McKay** 19 roll sheet leveler
Bay City bending rolls, 4″x3/16″

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⅝″x6′ No. 54 **Hendley & Whittemore**, punch, shear, and rod cutter with angle shear attachment
No. 1 **Long & Allstatter** alligator
Lewis alligator, 10″ blade
Newbold guillotine, 2″ capacity
No. 0-15 **Stanley Uni-shear**
36″x18 ga. Toledo No. 418 B.
No. 1 B **Campbell Nibbler**, 3/16″x24″
18″ **Pels** all steel beam shear
10 KVA **"DYER"** Topeka 220 v. new

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12 KVA **American Electric Fusion**, type BW 16.
17 KVA **Thomson Gibb**, 440 V., spot
20 KVA **Agnew**, type 10D, 440 V., spot
20 KVA **Taylor**, 440 V., spot, 14″ reach
20 KW **Taylor Moesta**, 440 V., portable gun type spot
20 KW **National**, spot, 28″ reach, 220 Volt
23 KVA **Winfield**, 440 V., spot
25 KW **Winfield**, spot, 220 V.
25 KW **Winfield**, 220 V., butt
30 KVA **Thomson**, 220 V., butt
35 KW **Federal**, type 60, 440 V., automatic upset butt
65 KW **Federal**, type 10A, 440 V., butt
150 KVA **American Electric Fusion**, type HJ 10, 440 volt, air operated multiple welder
150 KVA **Swift** flash butt welder, 440 Volt
375 KVA **Fisher "Autocrat"** press type.

MISCELLANEOUS

6A **Potter & Johnston** automatics
4′x¼″ **Cincinnati** press brake
36″ **Niles** car wheel vertical borer
22″, 24″ & 28″ **Steinle** turret lathes
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4″ **Beeman & Smith** double end boring mill
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12″ **Dill** slotter.
3″ No. 6 **Langeiler** swager
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No. 61AA **Bodine** screw & nut driver
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36"x15' SCHUMACHER & BOYE Quick Change Engine Lathe, cone drive.

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600 lb. MASSILLON board drop hammer.

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Ceiling Suspended Drill Unlimited drilling area
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Grinders: #20 Bryant Internal
300 other machinery items
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2—½″ capacity **Punch and Shears.**
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GEAR PLANERS, Bevel, 36″ & 54″ Gleason, M.D.
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GRINDER, 18′ x 30′ x 96′ Norton Cyl., M.D.
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PRESS, Hydr., 1000 ton Wood, platen 42″ x 9′
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#10 Ingersoll-Rand Imperial 850 cu.ft. displacement

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1″ x 18″ Pratt & Whitney Automatic Lathe

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44 Sp. Baush Multiple
36 Sp. Baush Multiple
4′ Fosdick Radial

GEAR MACHINES

2—#12 Barber Coleman Single Overarm

LATHES

32″ x 22′ New Haven
18″ x 8′ Lodge & Shipley Selective Geared Head
1″ x 18″ Pratt & Whitney Automatic

MILLS

24″ Cinn Automatic
18″ Cinn Automatic
#21 Brown & Sharpe Production S.P.D.

THREAD MILL

6″ x 14″ Pratt & Whitney Internal

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#4 Warner & Swasey
3″ x 36″ Jones & Lamson

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#16 B & S 11½" x 72"
Modern Grinders 16" x 60" blocks up to 22" M. D.
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Cincinnati 12" x 24" Universal M. D.

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21" x 10' LeBlond G. H. crank shaft lathe Q. C.
1—Lodge and Shipley 18" x 8' M. D.
Monarch 16" x 8' M. D. Q. C.
1—Davis 16" x 8' M. D. Q. C.
1—Prentice 20" x 10'
Lathe and Morse 24" x 12'

AUTOMATICS

2—National Acmes 55 M. D. #73
2—National Acmes 53
2—Clevelands ⅞" 4 spindle M. D.
2—New Britains 1" x 5"
1—4¼" Gridley
00 B & S

TURRET LATHES

1—2¼ x 24 J & L
1—2 x 24 J & L
1—Woods 1⅝" B. G.
1—Woods 1"

DRILLS

1—6' Prentice M. D.
1—4' Bigford
1—4' Niles M. D.
1—36" Niles Vertical
2—Foot Burts heavy duty
4—2 and single spindle Allens

SHAPERS

1—24" G. & E. M. D.
1—16" Becker M. D. and B. G.
1—16" Ohio
1—14" Chase
1—12" G. & E.

MISCELLANEOUS

Oeking Punch and Shear 4 x 4 angles
Binsee Horizontal Boring Mill 2"
1,000 lb. Chambersburg steam or air hammer
#3 Les Bradner thread Miller
1—26" Brown and Sharpe Gear Cutter
1—36" Fellows
1—3" x 36" G. & E. Spur Gear Cutter
1—Pratt and Whitney Thread Grinder
10", 12", and 14" Newton Slotters
1—Bedford 25 ton crane

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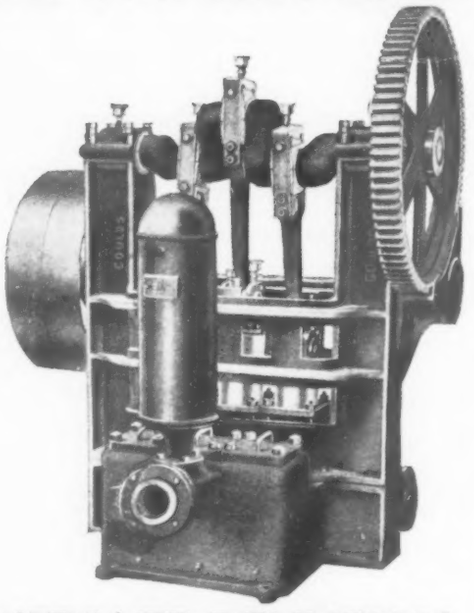

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No. 6 **Becker** Vertical Milling Machine; M.D.
Libby Type C—26" Turret Lathe; 7½" hole; M.D.
Gisholt 21" Turret Lathe; 6¼" hole.
N.B.P. 5' Radial Drill,, Universal Arm, S.P.D.
Sellers 3" Horizontal Boring & Drilling Machine.
No. 5 **Rock River** Bulldozer.
Natco 12 Spindle Drill, 18" Round Head, 1⅛ capacity.
Bausch 8 Spindle Drill, 33" round head, 1⅝ cap.
Bausch 12 spindle Drill, 36" round head, 1¼ cap.

ACME EQUIPMENT CO.

128 So. Clinton St. Chicago, Ill.

READY FOR DELIVERY

36" x 36" x 9' Niles-Bement-Pond Planer—2 Side Heads, Box Table Type—Motor Driven

4' Niles Radial Drill—Gear Box Drive
40" x 16' Lodge & Davis Engine Lathe
12" x 36" Modern Plain Cylindrical Grinder
⅞" & ½" Cleveland Model A, Automatic Screw Machines

INLAND MACHINERY CO.

48 S. CLINTON ST. CHICAGO

1—Wilmarth & Morman Tool & Cutter Grinder
1—No. 1 Garvin Tapper
2—Toledo Electric Welders
1—Dings Magnetic Separator
1—No. 2 Hannifin Air Arbor Press
1—Brinnel Tester
1—No. 2 Baxendale Punch Press, M.D.
1—No. 62 Bliss Punch Press, M.D.
1—No. 1A Wm. Sellers Tool Grinder
1—No. 3 Holmes Tilted Tapper
1—Universal Gear Tester
1—4 Spindle Barr Drill Press

Your Inquiries Receive Prompt Attention

CENTRAL MACHINE TOOL CORPORATION

122-126 Nebraska Ave. Toledo, O.

New "SEARCHLIGHT" Advertisements

Received by 10 A. M. Tuesday will appear in the issue out Thursday of the following week, subject to limitations of space available.

Departmental Staff
AMERICAN MACHINIST
330 W. 42nd St., New York

USED MACHINE TOOLS

OFFERED BY

A TIME TESTED, RELIABLE COMPANY

DRILLS

1 spdl. Henry & Wright
1 spdl. Leland-Gifford
2 spdl. Leland-Gifford Bench
2 spdl. Henry & Wright
4 spdl. Henry & Wright
4 spdl. Sigourney
4 spdl. Woodward & Rogers
6 spdl. Henry & Wright
2 spdl. Baker Cylinder Borer

GEAR CUTTERS

No. 60 BM Gould & Eberhardt Bevel Gear Rougher (2)

GRINDERS

(See page 195—special advertisement Hill-Clarke Cylindrical Grinders)

22"x96" Norton Plain, M.D., Roll Forming Attachment

No. 40 Bryant Plunge Cut, Wide Wheel, Oscillating

No. 10 Lees-Bradner Spur Gear Grinder

No. 60 Heald Cylinder

1½" dia. New Yankee Drill Grinder

LATHES

No. 4 AC LeBlond Auto. Duplex Crankshaft

SLOTTERS

10" Newton

TURRET LATHES

No. 3-F Foster Fastermatic Chucking Machine, Platen Type (2)

No. 3-F Foster Fastermatic Chucking Machine, Indexing Type (2)

MISCELLANEOUS

60" Quickwork Rotary Shear

6" Saunders Pipe Machine

No. 4 Gaterman Tapper, 5/16" Cap.

HILL-CLARKE MACHINERY CO.

651 W. WASHINGTON BLVD. CHICAGO

...IN STOCK

AUTOMATICS

No. 515 National Acme, four spindle
No. 52 National Acme, four spindle
No. 53 National Acme, four spindle
¼" Cleveland Model A, single spindle

BROACHES

No. XB10 Oilgear Hydraulic Twin Spdl.
15 Ton Hercules Vertical

DRILLS

4' Prentice Radial
No. 1½ Foote Burt, 2 spindle
No. 15½ Foote Burt Fixed Center
No. 37 Natco Multiple Spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gun Barrel, 2 spindle, m.d.

GEAR CUTTERS

No. 5 Cincinnati Automatic Gear Cutter
No. 3 Brown & Sharpe Automatic
No. 36 BM Gould & Eberhardt Rougher, three spindle
No. 6 Fellows Gear Shaper
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Grinder
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS

10"x20" Landis Cylindrical, hydraulic
12"x42" Landis Cylindrical
No. 55 Heald Cylinder
No. 60 Heald Cylinder
No. 24—53" Gardner Disc

LATHES

17"x8' Sidney, c.d.
18"x6' Lodge & Shipley, c.d.
18/24"x12' South Bend Gap, c.d.
26"x14' Niles Bement Pond, c.d.
17"x8' Wickes Production, c. d.
3½"x60' Fitchburg Lo-Swing, q.h.

TURRET LATHES

No. 3A Warner & Swasey, q.h.
No. 6A Potter & Johnston, q.h.
3x36 Jones & Lamson, q.h.
No. 9 Bardons & Oliver, c.d.

MILLS

No. 1½ B S Milwaukee, s.p.d. double o.a.
No. 1 Milwaukee Manufacturing, s.p.d.
No. 5C Becker, Vertical

MISCELLANEOUS

No. 3E Lees-Bradner Thread Miller, collet Type
⅝"x10' Nilson Wire Straightener
Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill
No. 2 Davis Keyseater

PLANERS AND SHAPERS

32"x32"x10' New Haven Planer
18" Lodge & Davis Shaper
20" Rockford Shaper

TAPPERS

½" Rickert Shafer Radial

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.

1959-69 South Meridian Street
INDIANAPOLIS, INDIANA

Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

LATHES

No. 324 Adriance Spinning

MILLING MACHINES

2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical
No. 30 Sunstrand Rigid Mill M.D.

TURRET LATHES

Goss & De Leeuw Chucking, 6"x6½"

DRILLS

3' Morris Radial En. Hd. M.D.
No. B16 Natco M.D. (2)
4 Spindle Taylor & Fenny M.D.

GEAR MACHINERY

6 Cimatool chamfering M.D.
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder

GRINDERS

No. 20 Heald Surface M.D.

MISCELLANEOUS

8" Bullard Multimatic M.D.
No. 1 Foote-Burt Duplex Surface Broach
8" Welland Standard Pipe Machine
No. 4 Hilles & Jones Double End Punch and Shear
No. 303 Bliss St. Side Gd. M.D.
2" Acme Bolt Threader

WIGGLESWORTH MACHINERY CO.

203 Bent St., Cambridge, Mass.

HIGH GRADE MACHINE TOOLS

LATHES

16" x 10' South Bend Gap Type Lathe. Standard Change.
42" x 14' Niles Lathe, Cone Drive.

GRINDERS

#60 Heald Internal, Belt Drive
#14—20" Besley Disc Grinder, Belt Drive.
16" x 72" Landis Self Contained Plain Grinder, M.D. Complete.
#5 Oliver Drill Grinding Machine, M.D.
#30 Heald Internal Cylinder Grinding Machine.

GEAR CUTTERS

#3—26" B & S Automatic Gear Cutter.
#1 Adams Gear Hobber, Belt Drive.
#00 Pfauter Gear Hobbing Machine, M.D.
#1 Schuchardt & Schutte Gear Hobbing Machines.
#18H Gould & Eberhardt Gear Hobbing Machine.
#5-60" B & S Automatic Gear Cutting Machine.
Biigram Automatic Gear Cutter.

BOLT & PIPE THREADERS

4" Williams Pipe Machine.

SHAPERS & PLANERS

16" Rockford Crank Shaper, Back Geared.
32" x 32" x 18' Gray Planer, 2 Heads.
60" x 48" x 18' Betts Planer, side Head and rail head.

MILLERS

48" x 35" x 8' Niles Bement Pond Planer Type Slab Miller, Adjustable rail, Two vertical Heads, Horiz. rail, M.D.

CINCINNATI MACHINERY & SUPPLY CO.

217 East Second St. Cincinnati, Ohio

ST. LOUIS' Headquarters FOR GOOD USED TOOLS, OFFERS:

ROCKFORD 24" S.P.D. Shaper
BULLARD 51" Vert. Boring Mill
MUELLER 4½' Gear Box Drive Radial Drill
PUTNAM 27"x14' Q.C.G. Lathe
BRIDGEPORT 32"x18' GRD. HD. Lathe
BECKER #25 Pl. Miller
NILES 12" Vert. Slotter
INGERSOLL 2—SP. Vert. Miller
B&S 48"x10" #4 Gear Cutter
FELLOWS #3 Gear Shaper
GOULD & EBERHARDT Rotary Milling Mach.

Write Us For Any Other Tools You May Want
Let Us Quote On All Machinery Needs

McDONALD MACHINERY CO.

1531-35 N. Broadway St. Louis, Mo.

200# B & S Board Drop Hammer.
800# B & S Board Drop Hammer.
#14 Cochrane-Ely Vert. Miller & Shaper, M.D.
Bolt Cutters 1"x1½"-2"-3"-4" Acme.
4' Bickford Radial Drill.
#55 Heald Internal Grinder.
10" Bridgeport Knife Grinder.
Turret Lathe, #2 W&S Fct. Head.
No. 2 Baker Keyseater, 2"x20".
Pipe machines 2"—18".

WEST PENN MACHINERY COMPANY

1210 House Bldg. Pittsburgh, Pa.

SEARCHLIGHT SECTION

144 INCH GLEASON STRAIGHT BEVEL GEAR PLANER

CAPACITY: Spur Gears to 144" Dia. x 16" Face, Bevel Gears to 100" Dia. x 16" Face

Motor Driven with 220 Volt, D.C. 1000 to 1800 R.P.M. Motor. With Standard Equipment and Large Assortment of Cutting Tools.

INDIANAPOLIS MACHINERY & SUPPLY CO.
INCORPORATED
1959-69 S. Meridian St., Indianapolis, Ind.

OTT MACHINERY SPECIALS

AUTOMATICS, Cleveland, 1¼ & 2, Model A
AUTOMATICS, Cleveland, ⅞" 4 spdle. Model M
AUTOMATICS, Cleveland, ⅞ & 1½" Model B, M. D.
AUTOMATICS, #22, 23 & 24 New Britain
GRINDERS, Landis 10x36" Hydraulic, M.D.
MILLING MACHINE, Lees-Bradner #3 Thread
MILLING MACHINES, Craftsman #1, 2 & 3
PLANERS, Bedford & Patch, 36"x13' Open Side with 1 Rail & 1 Side Head
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #2 to 6 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

WANTED

New Inventions • Equipment

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

ROLL LATHES

54"x20' Standard Compound Geared Head for direct motor drive with piano and necking rests. Limited service—Excellent condition.
42"x20' United Open Head, cone drive, with piano and necking rests. Good.

PLANERS

36"x36"x12' Flather, 2-Heads on rail, power elevation, motor mounted on housing, 10 HP, 3/60/220 volts. Est. Wt. 12,000 lbs. Very good condition.
42"x42"x10' Flather Double Housing, one head on rail, one side head., power elevation to cross-rail; arranged for belt drive. Catalog Wt. 21,000 lbs. Good operating condition.

(All for immediate delivery)

GALBREATH MACHINERY COMPANY
306 Empire Bldg. Pittsburgh, Pa.

FOR SALE

No. 8 **Ajax BULLDOZER**, M.D.
4" **Williams Pipe Machine**, M.D.
36" **Niles Wheel Lathe**, M.D.
90" **Niles Wheel Lathe**, M.D.
526 CFM **Ingersoll Rand Air Compressor.**

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave., Chicago, Illinois
37 years' experience
"*Anything* containing IRON or STEEL"

WANTED

USED 10' power squaring shear to cut 10 gauge metal. Also, a used Box & Pan Brake, 8' x 10 gauge with 6, 8, or 12" finger extension, motor driven.

DIAMOND ROOFING AND METAL WORKS
336 Maple Street Perth Amboy, N. J.

Wanted IMMEDIATELY

1—½" x 8'-10 Pyramid Roll
1—¼" x 10' Press or Apron Power Brake
1—10-20 Ton Bridge Crane 43' Span

THE LANG COMPANY
267 West First South Street
Salt Lake City, Utah

No. 2 P & W Shaving Machine
No. 6 Fellows Gear Shaper
No. 3 Crescent Saw Table
300-ton D & B Hydraulic Tire Press

D. E. DONY MACHINERY CO.
New and Used Machine Tools
47 Laurelton Road Rochester, N. Y.

FOR SALE
PLANER

Subject to prior sale:
One (1) 54" Gleason Single Tool Bevel Gear Planer. Serial #1563. This machine is in excellent condition—Complete with forms and 5-Horsepower motor drive and controls. Will cut 45" Mitre Gears or 60" Bevel Gears up to 4" Circular Pitch.

KEYSTONE ENGINEERING CO.
1442 South San Pedro St. Los Angeles, Calif.

New "SEARCHLIGHT" Advertisements

must be received by 10 A. M. Tuesday to appear in the issue out Wednesday of the following week.

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American Machinist
330 West 42nd St., New York City

Prompt ANSWERS to your business problems . . .

MISCELLANEOUS business problems are daily being solved, quickly and easily, by the use of the Searchlight Section of this and other McGraw-Hill publications.

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330 West 42nd Street • New York City

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Electrical World
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Food Industries
Power
Product Engineering
Textile World
Transit Journal

WHERE-TO-BUY DIRECTORY

ABRASIVE GRAIN & STONES (See GRAINS, Abrasive)

ABRASIVE PAPERS & CLOTH (See PAPER & CLOTH, Abrasive)

ALLOYS, Aluminum (See ALUMINUM)

ALLOYS, Copper
American Brass Co., Waterbury, Conn.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Revere Copper & Brass Inc., N. Y. C.

ALLOYS, Corrosion & Heat Resistant
Allegheny-Ludlum Steel Corp., Pittsburgh
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Bunting Brass & Bronze Co., Toledo, O.
Carboloy Co., Detroit
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Dow Chemical Co., Midland, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes-Stellite Co., N. Y. C.
Latrobe Electric Steel Co., Latrobe, Pa.
Mallory & Co., Inc., P. R., Indianapolis
Republic Steel Corp., Cleveland
Revere Copper & Brass, Inc., N. Y. C.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Div., Canton, O.

ALLOYS, Magnesium
American Magnesium Co., Pittsburgh
Dow Chemical Co., Midland, Mich.

ALLOYS, Special Iron
American Brake Shoe & Fdry. Co., N. Y. C.
Mechanite Research Institute, Pittsburgh

ALLOYS, Steel
Allegheny-Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
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Ingersoll Steel & Disc. Div., Newcastle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Electric Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
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Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O.
United States Steel Corp., Pittsburgh
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

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Aluminum Co. of America, Pittsburgh

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American Brass Co., Waterbury, Conn.
Revere Copper & Brass, Inc., N. Y. C.

ARBORS & MANDRELS
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Cushman Chuck Co., Hartford, Conn.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Gleason Works, Rochester, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee
Latrobe Electric Steel Co., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Warner & Swasey Co., Cleveland

ATTACHMENTS, Broaching Machine
Colonial Broach Co., Detroit

ATTACHMENTS, Grinding Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Liberty Tool & Gage Wks., Providence, R. I.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

ATTACHMENTS, Lathe
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Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Dumore Co., Racine, Wis.
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Monarch Machine Tool Co., Sidney, O.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Rockford Mach. Tool Co., Rockford, Ill.
South Bend Lathe Wks., So. Bend, Ind.
Strand Co., N. A., Chicago
Warner & Swasey Co., Cleveland

ATTACHMENTS, Milling
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Experimental Tool & Die Co., Detroit
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
Lempco Products, Inc., Bedford, O.
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
National Machine Tool Co., Cincinnati
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

ATTACHMENTS, Planer
Cincinnati Planer Co., Cincinnati
Sellers & Co., Inc., Wm., Philadelphia

ATTACHMENTS, Screw-Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Empire Tool Co., Detroit
Meisel Press Mfg. Co., Boston

ATTACHMENTS, Tapping
Avey Drilling Mach. Co., Cincinnati
Barber-Colman Co., Rockford, Ill.
Errington Mech. Lab., Stapleton, N. Y.
Greenlee Bros. & Co., Rockford, Ill.
Haskins Co., R. G., Chicago
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Machine & Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.

BABBITT (See METALS, Bearing)

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Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Federal Bearings Co., Poughkeepsie, N. Y.
SKF Industries, Inc., Philadelphia
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARRELS, Tumbling & Burnishing
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

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Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit
Elmes Engrg. Wks., Chas. F., Chicago
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Gairing Tool Co., Detroit
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National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Boring Mach. Co., Hudson, Mass.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BARS, Sine
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BATHS, Heat Treating & Annealing
Houghton & Co., E. F., Philadelphia

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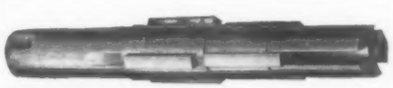
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Babbitt
Bunting Brass & Bronze Co., Toledo, O.

BEARINGS, Ball
Bantam Bearings Corp., So. Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Schatz Mfg. Co., Poughkeepsie, N. Y.
Torrington Co., Torrington, Conn.

Output Goes UP
Costs Go DOWN
with



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EXPANDING
MANDRELS

Economy tools . . . for holding work while being machined between centers on lathes, grinders, millers, shapers, etc. Hardened tool steel, accurately ground. Sold singly or in sets. Prompt delivery. Write for bulletin.

W. H. NICHOLSON & CO.
114 OREGON ST., WILKES-BARRE, PA.

Other Products: Arbor Presses—Control Valves—Steam Traps—Floats
Flexible Couplings—Compression Shaft Couplings

Eliminates some Costly Tools

CASE HISTORY
Number 4.

The adapters are clamped on a "V" block which in turn is mounted on a rotating table on a milling machine. A slotting tool ground to the exact dimension specified is fastened to the clapper box tool holder. . . Each spline is cut in a few minutes—after rotating to a new position—the operation is repeated until all of the splines are cut accurately, dimensioned and equally spaced . . . Broaching — the only alternative — would have involved the expense of a series of broaches and broaching operations because the splines stop at the shoulder of the adapter. . . Use of the SLOTMASTER required no tooling expense and only one set-up.

Thumbnail illustrates set up.

SLOTMASTER can be used on milling machines and provides double duty facilities at a minimum cost. It requires but little time to change-over from one head to the other. . . . The stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. . . . The tool holder of the clapper box type, can be turned in any position. . . . All of the working parts are of tool steel heat treated and ground to close tolerances. . . . SLOTMASTER comes complete with pulleys, motor, belt and mounting adaptable to round over-arm or flat-on-round overarm milling machines.

Send for 4-page catalog and give the specifications of the milling machines that you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE COMPANY
12615 Greiner
Detroit
Michigan

Conventional set-up on round over-arm milling machine.

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Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Torrington Co., Torrington, Conn.

BEARINGS, Non-Metallic
Bakelite Corp., N. Y. C.

BEARINGS, Oilless & Graphite
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Roller
Bantam Bearings Corp., So. Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Timken Roller Bearing Co., Canton, O.

BEARINGS, Thrust
(See preceding classifications)

BELLOWS, Seamless Metal
Chicago Metal Hose Corp., Maywood, Ill.

BELTING, Leather
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F. Philadelphia

BELTING, Rubber & Fabric
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

BELTS & BANDS, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Dumore Co., Racine, Wis.
Mid-West Abrasive Co., Detroit
Norton Company, Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Walls Sales Corp., N. Y. C.

BELTS "V"
Allis-Chalmers Mfg. Co., Milwaukee
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Col.

BENCHES, Shop
Baumbach Mfg. Co., E. A., Chicago
Delta Mfg. Co., Milwaukee
Hardinge Brothers, Inc., Elmira, N. Y.
Hill Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Boston
Standard Pressed Steel Co., Jenkintown, Pa.
Walker-Turner Co., Plainfield, N. J.

BENDERS, Hand
O'Neil-Irwin Mfg. Co., Minneapolis

BENDING & STRAIGHTENING Machines
Ajax Mfg. Co., Cleveland
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Wks., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

BINS, Tool & Parts (See **LOCKERS & SHELVING**)

BITS, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Black Drill Co., Cleveland
Carboloy Co., Detroit
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Crafts Co., Inc., Arthur A., Boston
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Latrobe Electric Steel Co., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Union Twist Drill Co., Athol, Mass.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

BLADES, Circular-Saw (See **SAW BLADES, Circular**)

BLADES, Cutter, Milling, Boring & Reaming (See **BITS, Tool**)

BLADES, Hack- & Band-Saw
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Clemson Bros., Inc., Middletown, N. Y.
Continental Machines, Inc., Minneapolis
Disston & Sons, Inc., Henry, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Thompson & Sons Co., Henry G., New Haven, Conn.
Victor Saw Works, Middletown, N. Y.

BLOCKS, Pillow
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Earle Gear & Mach. Co., Philadelphia
Fafnir Bearing Co., New Britain, Conn.
Farrel-Birmingham Co., Ansonia, Conn.
Hill Acme Co., Cleveland
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Standard Pressed Steel Co., Jenkintown, Pa.

BLOCKS, Precision Gage
Atometric Precision Gage Laboratories, Inc., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Webber Gage Co., Cleveland

BLOCKS, "V"
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Greenfield Tap & Die Corp., Greenfield, Mass.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Buffalo Forge Co., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Wagner Electric Corp., St. Louis

BLOWERS, Electric Hand
Buffalo Forge Co., Buffalo, N. Y.
Ideal Commutator Dresser Co., Chicago
Skilsaw, Inc., Chicago

BLUING, Layout
Dykem Co., St. Louis

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Eastern Machine Screw Corp., New Haven, Conn.
Federal Press Co., Elkhart, Ind.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haskins Co., R. G., Chicago
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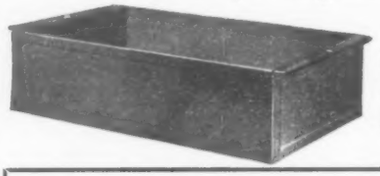

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Taft-Peirce Mfg. Co., Woonsocket, R. I.
V. & O. Press Co., Hudson, N. Y.

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Armstrong Bros. Tool Co., Chicago
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Lamson & Sessions Co., Cleveland
Republic Steel Corp., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BOLTS & NUTS
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Elastic Stop Nut Corp., Union, N. J.
Lamson & Sessions Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland
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Avey Drilling Mach. Co., Cincinnati
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Cincinnati Gilbert Mach. Tool Co., Cincinnati
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National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
Ohio Machine Tool Co., Kenton, O.
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Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Springfield Mach. Tool Co., Springfield, O.
Universal Boring Mach. Co., Hudson, Mass.
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Leland-Gifford Co., Worcester, Mass.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Sheffield Corp., Dayton, O.
Universal Boring Mach. Co., Hudson, Mass.

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Cincinnati Planer Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
King Machine Tool Co., Cincinnati
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Springfield Mach. Tool Co., Springfield, O.

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American Metal Works, Inc., Philadelphia, Pa.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

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Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Wks. Co., Cleveland

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General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

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Butterfield & Co., Derby Line, Vt.
Dalzen Tool & Mfg. Co., Detroit
Detroit Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

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Cincinnati Milling Mach. Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Foote-Burt Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
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Gardner Machine Co., Beloit, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
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Hill-Acme Co., Cleveland
Hisey-Wolf Machine Co., Cincinnati
Jefferson Mach. Tool Co., Cincinnati
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Mach. Co., New Britain, Conn.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
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Schauer Machine Co., Cincinnati
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Strand & Co., N. A., Chicago
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Vonnegut Moulder Corp., Indianapolis
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Beatty Mach. & Mfg. Co., Hammond, Ind.
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Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

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American Gas Furn. Co., Elizabeth, N. J.
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Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

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Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

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Ex-Cell-O Corp., Detroit
Metal Carbides Corp., Youngstown, O.
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CABINETS, Steel (See LOCKERS & SHELVING)

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Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS, Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cross Gear & Machine Co., Detroit
Hartford Special Machinery Co., Hartford, Conn.
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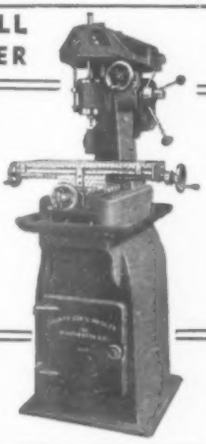

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Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
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CENTERS, Bench
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Dearborn Gage Co., Dearborn, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

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Brown & Sharpe Mfg. Co., Providence, R. I.
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Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Knight Machinery Co., W. B., St. Louis
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

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Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
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Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
American Chain & Cable Co., Bridgeport, Conn.

CHAINS, Transmission
Bilgram Gear & Mach. Wks., Philadelphia
Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
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Acromark Co., Elizabeth, N. J.
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Revere Copper & Brass Inc., N. Y. C.

CHISELS, Hand (See **TOOLS, Hand**)

CHISELS, Chipping, Pneumatic & Electric Hammer
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Black & Decker Mfg. Co., Towson, Md.
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Gorton Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Air (See **CHUCKS, Pneumatic**)

CHUCKS, Collet (See **Collets**)

CHUCKS, Drill & Tap
Atlas Press Co., Kalamazoo, Mich.
Errington Mech. Lab., Stapleton, N. Y.
Etco Tool Co., Brooklyn, N. Y.
Gisholt Machine Co., Madison, Wis.
Jacobs Mfg. Co., Hartford, Conn.
McCrosky Tool Corp., Meadville, Pa.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
North Bros. Mfg. Co., Philadelphia
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland

CHUCKS, Drill, Quick-Change, Collet
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Scully-Jones & Co., Chicago

CHUCKS, Gear
Cushman Chuck Co., Hartford, Conn.
Gleason Works, Rochester, N. Y.
Sheffield Corp., Dayton, O.

CHUCKS, Hydraulic
Cross Gear & Machine Co., Detroit
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
New Britain-Gridley Machine Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Lathe
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Cushman Chuck Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Harnischfeger Corp., Milwaukee
Hendey Machine Co., Torrington, Conn.
L-W Chuck Co., Toledo, O.
McCrosky Tool Corp., Meadville, Pa.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Geo., N. Y. C.
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS, Magnetic
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

CHUCKS, Motorized Electric
Cushman Chuck Co., Hartford, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Pneumatic
Cushman Chuck Co., Hartford, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Ring-Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Gardner Machine Co., Beloit, Wis.

CHUCKS, Spring
Brown & Sharpe Mfg. Co., Providence, R. I.
Harnischfeger Corp., Milwaukee
Rivett Lathe & Grinder, Inc., Boston

CLAMPS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
North Bros. Mfg. Co., Philadelphia
Williams & Co., J. H., Buffalo, N. Y.

CLEANERS, Metal (See **COMPOUNDS, Cleaning**)

CLEANING EQUIPMENT (See **METAL-CLEANING EQUIPMENT**)

CLOTH, Abrasive (See **PAPER & CLOTH, Abrasive**)

CLUTCHES, Friction
Ajax Mfg. Co., Euclid, Cleveland
Allis-Chalmers Mfg. Co., Milwaukee
Carlyle Johnson Machine Co., Manchester Conn.
Errington Mech. Lab., Stapleton, N. Y
Foote Bros. Gear & Machine Co., Chicago
Hill Acme Co., Cleveland, O.
Lipe-Rollway Corp., Syracuse, N. Y.
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Indianapolis

COLLARS, Safety
American Pulley Co., Philadelphia
Carlyle Johnson Machine Co., Manchester, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLARS, Spacing
Atkins & Co., E. C., Indianapolis
Hill Acme Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Scully-Jones & Co., Chicago
Standard Pressed Steel Co., Jenkintown, Pa.

COLLECTORS, Dust
Blake Co., Edward, Newton Centre, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Covel Mfg. Co., Benton Harbor, Mich.
Torit Mfg. Co., St. Paul, Minn.

COLLETS
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cushman Chuck Co., Hartord, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
National Twist Drill & Mach. Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Van Norman Mach. Tool Co., Springfield, Mass.
Warner & Swasey Co., Cleveland

COMPARATORS, Dial
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

COMPARATORS, Gear-Tooth & Screw-Thread
Farrel-Birmingham Co., Buffalo, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.
Vard, Inc., Pasadena, Calif.

COMPASSES, Metal-Scribing (See **CALIPERS & COMPASSES**)

COMPOUNDS, Cleaning
Bullard Co., Bridgeport, Conn.
Detroit Rex Products Co., Detroit
Houghton & Co., E. F., Philadelphia
Oakite Products, N. Y. C.
Turco Products, Inc., Los Angeles

COMPOUNDS, Drawing, Metal & Wire
Houghton & Co., E. F., Philadelphia
Shell Oil Co., Inc., N. Y. C.

COMPOUNDS, Grinding & Polishing
Carborundum Co., Niagara Falls, N. Y.
National Broach & Machine Co., Detroit
Norton Co., Worcester, Mass.

COMPOUNDS, Plastic Molding
Bakelite Corp., N. Y. C.
Dow Chemical Co., Midland, Mich.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

COMPOUNDS, Tempering & Case-Hardening
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Strong, Carlisle & Hammond Co., Cleveland
Stuart Oil Co., D. A., Chicago

COMPRESSORS, Air & Gas
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Curtis Pneumatic Machry. Co., St. Louis
General Electric Co., Schenectady, N. Y.
Wright Mfg. Div. of Amer. Chain & Cable Co., York, Pa.

CONSULTANTS
Trundle Engrg. Co., Cleveland

CONTOUR MACHINES
Continental Machines, Inc., Minneapolis
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CONTRACT WORK (See also Index, last page)
Aluminum Co. of America, Pittsburgh
Baldwin Southwark Corp., Philadelphia
Bayard & Co., M. L., Philadelphia
Chapman-Valve Mfg. Co., Boston (Heat-Treating)
Chromium Corp. of Amer., N.Y.C. (Plating)
Continental Can Co., Inc., N. Y. C.
Eastern Machine Screw Corp., New Haven, Conn.
Elmes Engrg. Wks., Chas. F., Chicago
Ericcson Screw Machine Prod. Inc., Brooklyn, N. Y.
Excello Corp., Detroit (Heat-Treating)
Fenn Mfg. Co., Hartford, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.

WHERE-TO-BUY DIRECTORY

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Jefferson Mach. Tool Co., Cincinnati
Carlyle Johnson Machine Co., Manchester, Conn.
Kent-Owens Machine Co., Toledo, O.
Kropp Forge Co., Chicago (Forgings)
Liberty Tool & Gage Wks., Providence, R. I. (Jigs & Fixtures)
Meisel Press Mfg. Co., Boston
National Acme Co., Cleveland
National Twist Drill & Tool Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn. (Screw Machine Products)
Revere Copper & Brass, Inc., N. Y. C. (Forgings)
Scher Engrg. Co., George, Newark, N. J.
Surface Combustion Corp., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
United Chromium, Inc., N. Y. C., (Plating)
Vard, Inc., Pasadena, Calif.
Waltham Watch Co., Waltham, Mass.
Watson-Stillman Co., Roselle, N. J.
Williams & Co., J. H., Buffalo, N. Y.

CONTROLLERS, Motor
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland
Square D Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

CONTROLLERS, Pressure & Temperature
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago

CONTROLS, Flexible-Shaft (See SHAFTS, Flexible)

CONTROLS, Furnace
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago
Strong, Carlisle & Hammond Mach. Co., Cleveland

CONTROLS, Hydraulic
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.
Watson-Stillman Co., Roselle, N. J.

CONVEYORS
Allis-Chalmers Mfg. Co., Milwaukee
Mathews Conveyer Co., Ellwood City, Pa.
Standard Conveyor Co., N. St. Paul, Minn.

COOLANT SYSTEMS, Portable
Gray Mills Co., Chicago

COOLANTS, Cutting, Drilling & Grinding
Carborundum Co., Niagara Falls, N. Y.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Shell Oil Co., Inc., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C
Standard Oil Co. of Ind., Chicago
Stuart Oil Co., Ltd., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

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Barnes Drill Co., Rockford, Ill.
Bicknell-Thomas Co., Greenfield, Mass.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit.
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

COUNTERSHAFTS
American Tool Works Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Mach. Co., Philadelphia
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
LeBlond Mach. Tool Co., R. K., Cincinnati
Rivett Lathe & Grinder, Inc., Boston
Stow Mfg. Co., Binghamton, N. Y.
Warner & Swasey Co., Cleveland

COUNTERSINKS (See DRILLS, Twist)

COUNTERS, Revolution & Stroke
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

COUPLINGS, Hose
Cleveland Pneu. Tool Co., Cleveland
Schrader's, Son, A., Brooklyn, N. Y.

COUPLINGS, Shaft, Flexible
Allis-Chalmers Mfg. Co., Milwaukee
Delta Mfg. Co., Milwaukee
Earle Gear & Mach. Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Foote Bros. Gear & Mach. Co., Chicago
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

COUPLINGS, Shaft, Non-Flexible
General Electric Co., Schenectady, N. Y.
Hill Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown Pa.

CRANES, Jib
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Portable
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Overhead Traveling
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CUPS, Oil & Grease
Gits Bros. Mfg. Co., Chicago

CUSHIONS, Die
V. & O. Press Co., Hudson, N. Y.

CUTTERS, Angle
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
McCrosky Tool Co., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago

CUTTERS, Die-Sinking
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Gorton Machine Co., Geo., Racine, Wis.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Formed
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Tomkins Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

CUTTERS, Gear
Adams Co., Dubuque, Iowa
Bantam Bearings Corp., S. Bend, Ind.
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.

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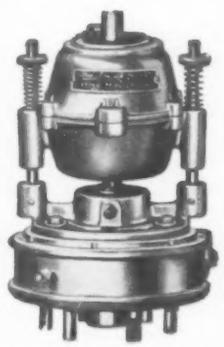

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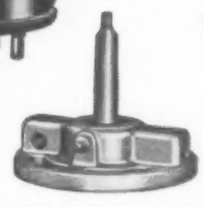
Above: Drive Unit of Tapping Head with a gear case assembly attached.

At Right: Drive Unit for Drilling. All gear cases are interchangeable on the two heads.



BULLETIN No. 3 gives full details about this production-boosting system of interchangeable heads. Copy mailed on request.

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TAPPING ATTACHMENTS • TAPPING MACHINES

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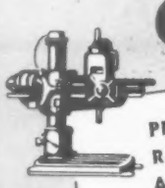

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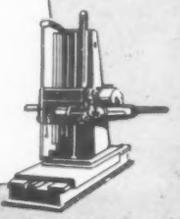
AND
HORIZONTAL
DRILLING, BORING
AND MILLING
MACHINES



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Waltham Mach. Wks., Waltham, Mass.

CUTTERS, Hand Pipe (See STOCKS, DIES & CUTTERS, Pipe)

CUTTERS, Keyseater
Baker Bros., Inc., Toledo, O.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Keyseater Co., Rochester, N. Y.
Ex-Cell-O Corp., Detroit
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Michigan Tool Co., Detroit
Mitts & Merrill, Saginaw, Mich.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Machine Tool Co., Cincinnati
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

CUTTERS, Milling
Adams Company, Dubuque, Ia.
Atlas Press Co., Kalamazoo, Mich.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gorton Mach. Co., George, Racine, Wis.
Grayson Mfg. Co., Monrovia, Cal.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Kearney & Trecker Corp., Milwaukee
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Waltham Mach. Wks., Waltham, Mass.
Weldon Tool Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

CUTTERS, Wire
Ideal Commutator Dresser Co., Chicago

CUTTING-OFF MACHINES (See SAWS)

CUTTING-OFF MACHINES, Abrasive-Wheel
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Campbell Div., Andrew C., American Chain & Cable Co., Bridgeport, Conn.
de Sanno & Sons, Inc., A. P., Philadelphia
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Racine Tool & Mach. Co., Racine, Wis.

CYLINDERS, Air (See TANKS & CYLINDERS, Air)

CYLINDERS, Hydraulic (See PRESSES, Hydraulic)

DEALERS, Machinery (See Searchlight Section)

DEGREASERS (See Metal Cleaning Equipment)

DEMAGNETIZERS
Abrasive Machine Tool Co., E. Providence, R. I.
Blanchard Mach. Co., Cambridge, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

DIAMONDS, Industrial
Carboloy Co. Inc., Detroit
Coldset Diamond Tool Co., N. Y. C.
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Roselaar, Louis A., N. Y. C.
Smit & Sons, Inc., J. K., N. Y. C.

DIE-CASTING MACHINES
Continental Machines, Inc., Minneapolis
Reed-Prentice Corp., Worcester, Mass.

DIE-HEADS, Threading
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Chaso Tool Co., Royal Oak, Mich.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap and Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland

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Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., Detroit
Danly Mach. Specialties, Inc., Chicago
Dykem Co., St. Louis
Lufkin Rule Co., Saginaw, Mich.
Masonite Corp., Chicago
Producto Mach. Co., Bridgeport, Conn.
Starrett Co., L. S., Athol, Mass.

DIE-MAKING & CUTTING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Gorton Machine Co., Geo., Racine, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
Illinois Tool Works, Chicago
Johnson Tool Co., E. Providence, R. I.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.

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Card Mfg. Co., S. W., Mansfield, Mass.
Dandy Mach. Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DIE-SINKING MACHINES
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Gorton Machine Co., Geo., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.

DIES, Marking & Embossing
Acromark Co., Elizabeth, N. J.
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.

DIES, Screw-Cutting, Adjustable
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Sheet-Metal & Forging
Hamilton Tool Co., Hamilton, O.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES, Solid Bolt & Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.

WHERE-TO-BUY DIRECTORY

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Consolidated Machine Tool Corp., Rochester, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland

DIES, Sub-Press
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Specialties, Inc., Chicago
Producto Machine Co., Bridgeport, Conn
V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass

DIES, Wire-Drawing & Extrusion
Carboloy Co., Inc., Detroit
Crafts Co., Arthur A., Boston
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DISKS, Abrasive (See **WHEELS, Grinding & Polishing**)

DISKS, Circular Cuttting
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Morse Twist Drill and Machine Co., New Bedford, Mass.

DIVIDERS (See **CALIPERS & COMPASSES**)

DOGS, Lathe & Milling-Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Hendey Machine Co., Torrington, Conn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Ready Tool Co., Bridgeport, Conn.
Sturdimatic Tool Co., Detroit
Williams & Co., J. H., Buffalo, N. Y.

DRESSERS, Grinding Wheel
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis
Black & Decker Mfg. Co., Towson, Md.
Carboloy Co., Inc., Detroit
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Disston & Sons, Inc., Henry, Philadelphia
Dumore Co., Racine, Wis.
Ideal Commutator Dresser Co., Chicago
Metal Carbides Corp., Youngstown, O.
Norton Co., Worcester, Mass.
Schultz & Anderson Co., Newark (Radius)
Smit & Sons, J. K., N. Y. C.
Standard Tool Co., Cleveland
Victor Machinery Exchange, N. Y. C.

DRESSING, Belt
Houghton & Co., E. F., Philadelphia
Tide Water Associated Oil Co., N. Y. C.
White & Bagley, Worcester, Mass.

DRIERS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
Tolhurst Div., American Machine & Metals, Inc., East Moline, Ill.

DRIFTS, Drill
Armstrong Bros. Tool Co., Chicago
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Standard Tool Co., Cleveland

DRILLROD, Steel Tool (See **STEEL, Tool**)

DRILLS, Automatic & Semi-Automatic
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill
Barnes Drill Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear and Machine Co., Detroit
Davis & Thompson Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill

DRILLS, Bench
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Ryerson & Son, Jos. T., Chicago
Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

DRILLS, Breast (See **TOOLS, Hand**)

DRILLS, Center
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill and Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRILLS, Column-Type
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Dalzen Tool & Mfg. Co., Detroit
Davis & Thompson Co., Milwaukee
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind
Snyder Tool & Engrg. Co., Detroit

DRILLS, Core
Bicknell Thomas Co., Greenfield, Mass.
Carboloy Co., Inc., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Wendt Sonis Co., Hannibal, Mo.

DRILLS, Flat (See **DRILLS, Twist & Flat**)

DRILLS, Hand (See **TOOLS, Hand**)

DRILLS, Horizontal
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, Ohio
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bradford Machine Tool Co., Cincinnati
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Machine and Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Universal Boring Mach. Co., Hudson, Mass.

DRILLS, Deep-Hole
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DRILLS, Multi-Spindle or Gang
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenlee Bros. & Co., Rockford, Ill.
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Snyder Tool & Engrg. Co., Detroit

DRILLS, Portable Electric (See **TOOLS, Portable Electric**)

DRILLS, Portable Pneumatic (See **TOOLS, Portable Pneumatic**)

DRILLS, Radial
American Tool Works Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Carlton Machine Tool Co., Cincinnati
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Mach. Tool Co. Cincinnati
Cleveland Punch & Shear Works, Inc., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Morris Machine Tool Co., Cincinnati

DRILLS, Sensitive
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
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Dalzen Tool & Mfg. Co., Detroit
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Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
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Walker-Turner Co., Inc., Plainfield, N. J.

DRILLS, Twist & Flat
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Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRIVES, Machine
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Drive-All Mfg. Co., Detroit
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Reed-Prentice Co., Worcester, Mass.
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Sheldon Mach. Co., Chicago
Turner Machinery Co., Kansas City, Mo.

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DRIVES, "V"-Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

DRIVES, Worm
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Bilgram Gear & Mach. Wks., Philadelphia
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Earle Gear & Mach. Co., Philadelphia
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
Grant Gear Works, Boston
Michigan Tool Co., Detroit
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

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Air Reduction, N. Y. C.
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Haynes-Stellite Co., N. Y. C.
Lincoln Electric Co., Cleveland
McKay Co., Pittsburgh, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
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Ryerson & Son, Inc., Jos. T., Chicago
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Barrett Co., Leon J., Worcester, Mass.
Tolhurst Div., American Machine and Metals, Inc., East Moline, Ill.

ENAMELS (See **PAINTS, VARNISHES, etc.**)

ENGRAVING MACHINES
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Ideal Commutator Dresser Co., Chicago
Moore Mfg. Co., Wm., Chicago
Reed-Prentice Co., Worcester, Mass.

EXTRACTORS, Centrifugal Oil (See **SEPARATORS, Centrifugal**)

EXTRACTORS, Screw
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland

FANS, Man-Cooler (See **BLOWERS**)

FEEDS, Die (See **FEEDS, Press**)

FEEDS, Hydraulic
American Engineering Co., Philadelphia
Ex-Cell-O Tool Corp., Detroit
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.

FEEDS, Press
Federal Press Co., Elkhart, Ind.
Henry & Wright Mfg. Co., Hartford, Conn.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Producto Machine Co., Bridgeport, Conn.
Schrader's Sons, A., N. Y. C.
V. & O. Press Co., Hudson, N. Y.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FILE BANDS
Do All Co., Inc., Des Plaines, Ill.

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Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Nicholson File Co., Providence, R. I.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Inc., Binghamton, N. Y.
Strand & Co., N. A., Chicago

FILES, Rotary
Disston & Sons, Inc., Henry, Philadelphia
Hamilton Tool Co., Hamilton, O.
Strand & Co., N. A., Chicago

FILING MACHINES, Die
Ames Co., B. C., Waltham, Mass.
Continental Machines Inc., Milwaukee
Do All Co., Inc., Des Plaines, Ill.
Illinois Tool Co., Chicago
Oliver Instrument Co., Adrian, Mich.

FILTERS, Air
Cleveland Pneu. Tool Co., Cleveland
Curtis Pneu. Machy. Co., St. Louis
Norton Company, Worcester, Mass.

FINGERS, Feed
Eastern Machine Screw Corp., New Haven, Conn.
Hardinge Brothers, Inc., Elmira, N. Y.
Mitts & Merrill, Saginaw, Mich.
Rivett Lathe & Grinder, Inc., Boston

FITTINGS, Hydraulic
Lamson & Sessions Co., Cleveland
Watson-Stillman Co., Roselle, N. J.

FITTINGS, Wire-Rope
American Chain & Cable Co., Bridgeport, Conn.
American Steel & Wire Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Roebling's Sons Co., John A., Trenton, N. J.

FIXTURES, Indexing
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Jefferson Mach. Tool Co., Cincinnati

FLAME-CUTTING MACHINES
Air Reduction, N. Y. C.
Oster Mfg. Co., Cleveland

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Foredom Electric Co., N. Y. C.
Haskins Mfg. Co., R. G., Chicago
Strand Mfg. Co., N. A., Chicago

FLUX, Liquid & Paste
Air Reduction, N. Y. C.
Atkins & Co., E. C., Indianapolis
Lincoln Electric Co., Cleveland

FORGES
Buffalo Forge Co., Buffalo, N. Y.

FORGING MACHINES (See also **PRESSES, Forging**)
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Elmes Engrg. Wks., Chas. F., Chicago
Hill-Acme Co., Cleveland

FORGINGS (See Contract Work)

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Cleveland Punch & Shear Wks., Cleveland
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Elmes Engrg. Works, Chas. F., Chicago
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Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FURNACES, Electric
Electric Furnace Co., Salem, O.
General Electric Co., Schenectady, N. Y.
Lindberg Engineering Co., Chicago
Surface Combustion Corp., Toledo, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

FURNACES, Gas
American Gas Furn. Co., Elizabeth, N. J.
Chicago Flexible Shaft Co., Chicago
Electric Furnace Co., Salem, Ohio
Hones, Inc., Chas. A. Baldwin, N. Y.
Lindberg Engineering Co., Chicago
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo

FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
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Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Morse Twist Drill Co., New Bedford, Mass.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

GAGES, Height
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Carboloy Co., Detroit
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Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Specht Engrg. Co., Brooklyn, N. Y.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See GAGES, Plug & Ring)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

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Air Reduction, N. Y. C.

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Bilgram Gear & Mach. Wks., Philadelphia
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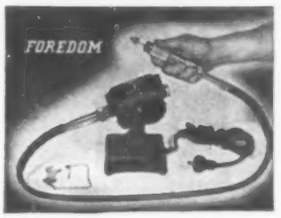
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark, N. J.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

GEAR-TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Ansonia, Conn.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

GEARS, Cut
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Braun Gear Corp., Brooklyn, N. Y.
Carlyle Johnson Machine Co., Manchester, Conn.
Cincinnati Gear Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.

FOREDOM FLEXIBLE SHAFT MACHINES Solve Many Production and Maintenance Problems



In the making of an intricate die or mold . . . in the de-burring, finishing, cleaning, polishing, etc. of small irregularly-shaped parts, or in the removing of high spots on gears (WITHOUT an expensive DISASSEMBLY and RE-SET) . . . in any one of many similar tasks—you can rely on a FOREDOM to do a better and quicker job.

These features combine to make FOREDOM MACHINES the most versatile of war plant aids: 1) Four types of interchangeable handpieces, including sizes as small as a pencil; 2) A choice of suspension or bench type; 3) A wide range of accessories. For close corner work FOREDOMS have no equal.

SERVING AT VITAL SPOTS IN LEADING WAR PLANTS

Many production men are spotting these general utility FOREDOMS at convenient points about their plants, particularly at EACH POINT OF FINAL ASSEMBLY OF SMALL PARTS. FOREDOM MACHINES are used on metal, plastics, glass, wood, porcelain, etc. Ideal for identification-marking of products and tools. Less fatiguing to women operators. Hundreds of war plants are eliminating time-taking hand jobs with FOREDOMS. These include: Ford, General Motors, Bendix, Westinghouse, Warner, Allis-Chalmers, Remington Arms, Curtiss-Wright.

Model illustrated is FOREDOM No. 340. Comes with either foot- or hand-operated rheostat at $45.70. (Available with suspension-type motor, No. 240 at $43.20, including foot rheostat). Other models as low as $23.50.

Order from your supply house, or direct. Write for complete Catalogue No. 362

FOREDOM Electric Co.
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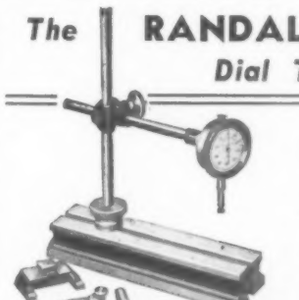
The RANDALL & STICKNEY Dial Test Indicator



A valuable instrument for erectors and inspectors

Especially convenient for checking accuracy in surfaces and spindle movements; also for obtaining comparative measurements on close work and for lining up work on machine tools. Horizontal arm adjustable and can be removed for independent use. With blocks fitted into T slot of base, this R&S indicator can be used against edge of surface plate for checking accuracy of long horizontal surfaces.

Dial diameter 2⅛"; base 8½x2¼".

Complete details on request.

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ELECTRIC FURNACES FUEL FIRED

FURNACES
Gas Fired, Oil Fired or Electric
For any Product, Process or Production
Send your inquiries direct to
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new, made in plain tool steel or special non-expanding, high abrasion-resistant gage steel, A.G.D.S. or to print.

WORN GAGES SALVAGED
brought back to original size by Special Hard Chromium Plating. All work finished at 68° F. Good deliveries.

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409 Atlantic Avenue Brooklyn, N. Y.

★ Modern
★ Economical
★ Rugged

REED SENSITIVE DRILLING MACHINES

Infinite Speeds from 1500 to 10,000 R.P.M. Instantly Available

This bench type machine—streamlined, sturdy, simple and accurate—is totally enclosed. Its wide range of instantly available spindle speeds assures utmost versatility for handling a wide range of work.

Features include spindle mounted in precision ball bearings, direct motor drive to spindle through single belt. Ruggedness is assured by base and column which comprise only two castings.

SPECIFICATIONS

Capacity ¼"; Spindle travel 3"; adjustment of head 3"; center spindle to column 7"; spindles center to center 9".

Built in 1, 2, 3 and 4 spindle types.

Detailed specifications and full information available on request

PRODUCTION MACHINE CO.

Also manufacturers of Hand and Automatic Polishing and Grinding Machines and Universal Tool Grinders.

GREENFIELD, MASS.

The **NEW**
PORTMAN
Rotary
SURFACE GRINDER

with advanced features assuring speed and accuracy

This new machine is of unit construction having a heavy box type base containing coolant system, a rugged motor head column, roller mounted column sub-base and fixed, magnetic rotary chuck drive incorporated in base of machine. Drive is by a totally enclosed 7½ H.P. motor mounted integral with precision spindle head. Motor head and column are adjustable for concave, convex and flat surface grinding.

Five speeds for all classes of work are provided by magnetic chuck drive. Machine has a capacity for handling work 14" diameter and 9" high. Simplified control assures easy handling and maximum production.

Investigate!

PORTMAN MACHINE TOOL CO.

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Stahl Gear & Machine Co., Cleveland

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Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Adams Co., Dubuque, Iowa
Bakelite Corp., N. Y. C.
Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland
Taylor Machine Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

GOGGLES, Face Shields & Sweat Bands
American Optical Co., Southbridge, Mass.

GRAINS, Abrasive
Bay State Abrasive Prod. Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Tiffin, O

GRINDERS, Abrasive-Belt
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Mattison Machine Works, Rockford, Ill
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass
Walker-Turner Co., Inc., Plainfield, N. J
Walls Sales Corp., N. Y. C.

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Atlas Press Co., Kalamazoo, Mich.
Black & Decker Mfg. Co., Towson, Md
Blount Co., J. G., Everett, Mass.
Boyar-Schultz Corp., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Machinery & Engrg. Co., Chicago
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Hardinge Brothers, Inc., Elmira, N. Y.
Hobart Brothers, Troy, Ohio
Norton Co., Worcester, Mass.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Queen City Machine Tool Co., Cincinnati
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J
Walls Sales Corp., N. Y. C.

GRINDERS, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Excello Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour
Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool
Abrasive Mach. Tool Co., E. Providence, R. I.
Barber-Colman Co., Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Boyar-Schultz Corp., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Carboloy Co., Inc., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
General Machinery Corp., Boston
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
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Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
National Acme Co., Cleveland
Norton Co., Worcester, Wass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sellers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

Simplex-M Abrasive Band Grinder

This grinder speeds production and cuts cost—abolishes expensive hand emerying or filing operations. The use of this modern machine assures straight grain finishes with sharp edges. *Write for new catalog on this and other sizes.*

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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Walls Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
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Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Hisey-Wolf Machine Co., Cincinnati
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

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Abrasive Mach. Tool Co., E. Providence, R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston
Sav-Way Tool & Mach. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Jig
Moore Spec. Tool Co., Bridgeport, Conn.

GRINDERS, Knife & Shear-Blade
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.

GRINDERS, Lathe-Attachment (See ATTACHMENTS, Lathe)

GRINDERS, Portable Electric (See also TOOLS, Portable Electric)
Black & Decker Mfg. Co., Towson, Md
Chicago Wheel & Mfg. Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Hisey-Wolf Machine Co., Cincinnati
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.
Hammond Machy. Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland
Landis Tool Co., Waynesboro, Pa.
Leach Machinery Co., H., Providence
Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Norman Machine Tool Co., Mt. Vernon, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Swing-Frame
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jefferson Machine Tool Co., Cincinnati
Vonnegut Moulder Corp., Indianapolis

GRINDERS, Thread
Ex-Cell-O Corp., Detroit
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
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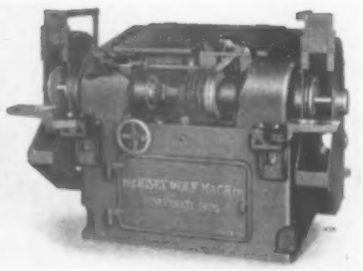
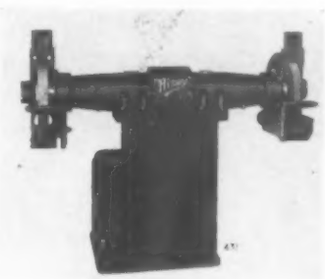
LeBlond Mach. Tool Co., R. K., Cincinnati
Morse Twist Drill & Machine Co., New Bedford, Mass.

Sturdy
GRINDERS
for tough
FOUNDRY SNAGGING



with speed changes to keep the wheels going at 1½ miles a minute!

High Speed Wheels must operate at 8000 to 9500 feet per minute to maintain their efficiency and economy. HISEY Snagging Grinders provide the speed changes to maintain the speed as the wheels wear. Extra large tool rests, adjustable to any position, stream lined design, extra large ball bearings and spindles also keep these machines on the job 168 hours per week.



(Above) 3 Speed Grinder for 24 or 30 inch high speed or vitrified grinding wheels. Note all moving and rotating parts such as motor, spindle and V belt drive completely enclosed and protected in large smooth hood (easily cleaned)

(Left) Wide Range Grinder with extended spindles for handling long and awkward shaped pieces.

Many other Grinders not shown both in Direct drive and V belt drive models from ¼ to 20 H.P. capacity (6 inch to 30 inch wheel size).

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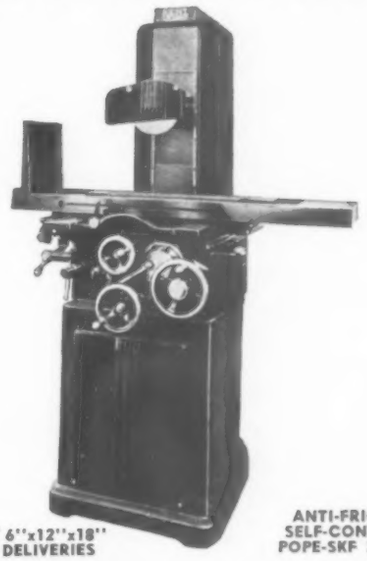
THE HISEY-WOLF MACHINE CO. CINCINNATI, OHIO.

ATLANTIC
No. 2 Automatic Precision Type
SURFACE GRINDER



CAPACITY 6"x12"x18"
PROMPT DELIVERIES

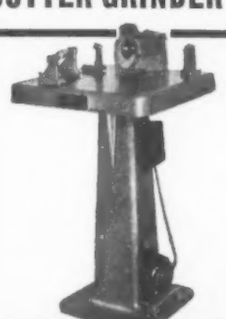
ANTI-FRICTION
SELF-CONTAINED
POPE-SKF SPINDLE

ATLANTIC MACHINERY CORP.
149 Broadway New York, N. Y.

The BARNES PRECISION CUTTER GRINDER

Grinds any profile desired with SPEED and ACCURACY

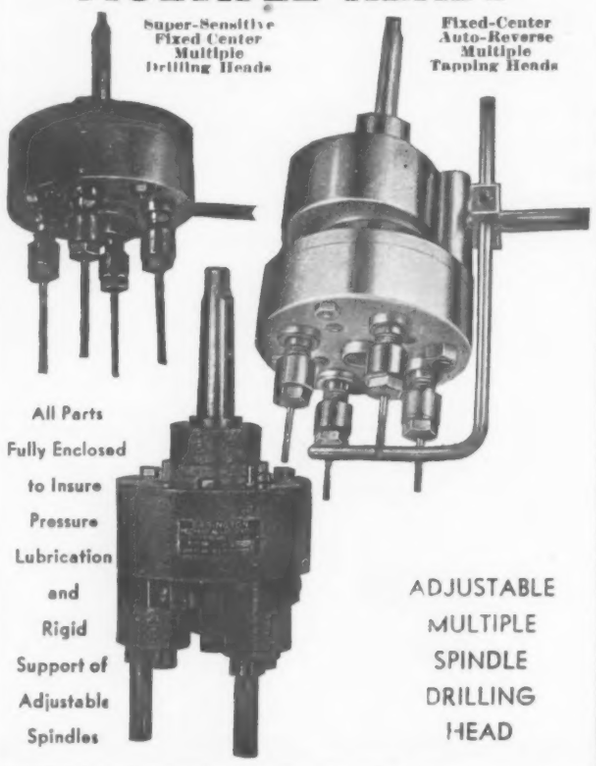
Regardless of how complicated or irregular the gang or cutter, the "Barnes" will grind it to the exact form desired with an accuracy that leaves nothing to be desired.
The speed and savings assured by this machine are available without any need to change existing cutter equipment. With the Barnes Precision Cutter Grinder the use of profile ground formed cutters is made possible thereby assuring the production of the high quality and quantity of work for which this type of cutter is so well known.



Write for Descriptive Circular

GENERAL MACHINERY CORP.
140 Federal St. Boston, Mass.

ERRINGTON
STAPLETON, STATEN ISLAND, N. Y.
MULTIPLE HEADS


Super-Sensitive Fixed Center Multiple Drilling Heads
Fixed-Center Auto-Reverse Multiple Tapping Heads
All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD

FLATNESS and SMOOTHNESS of Production Parts
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.
Ultra-Lap MACHINE COMPANY
207 McDOUGALL AVE. · DETROIT, MICH.

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Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

GRINDING, Centerless (See CONTRACT WORK)

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Junkin Safety Appliance Co., Louisville, Ky.
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HAMMERS, Drop
Farrel-Birmingham Co., Ansonia, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneu. Tool Co., Cleveland

HAMMERS, Power
General Machinery Corp., Hamilton, O
Sellers & Co., Wm., Philadelphia

HAMMERS, Softfaced
Greene, Tweed & Co., N. Y. C.
Johnson Tool Co., Inc., E. Providence, R. I

HANDLES, Crank & Machine
Machine Products Corp., Detroit
Williams & Co., J. H., Buffalo, N. Y.

HANDLES, File
Disston & Sons, Inc., Henry., Philadelphia
Nicholson File Co., Providence, R. I.
Parker-Kalon Corp., N. Y. C.

HANGERS, Shaft
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Fafnir Bearing Co., New Britain, Conn.
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
SKF Industries, Inc., Philadelphia

HARDENING MACHINES, Flame
Air Reduction, N. Y. C.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt
Gleason Works, Rochester, N. Y.

HEADERS, Rivet
Ajax Mfg. Co., Cleveland
Grant Mfg. & Mach. Co., Bridgeport, Conn
Hill Acme Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.

HEADS, Boring
Bullard Co., Bridgeport, Conn.
Carboloy Co., Inc., Detroit
Criterion Mach. Wks., Beverly Hills, Cal.
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Calif.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co. Inc., Springfield, Vt
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

HEADS, Dividing
Brown & Sharpe Mfg. Co., Providence, R. I
Cincinnati Milling Mach. Co., Cincinnati
Hartford Special Machry. Co., Hartford Conn.
Jefferson Mach. Tool Co., Cincinnati
L-W Chuck Co., Toledo, O.
Scherr Co., Geo., N. Y. C.

HEADS, Drilling
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Errington Mech. Lab., Stapleton, N. Y.
Ettco Tool Co., brooklyn, N. Y.
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

HEADS, Grinding
Ex-Cell-O Corp., Detroit
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Machine Co., Waynesboro, Pa.

HEADS, Milling
Cincinnati Milling Mach. Co., Cincinnati
Kempsmith Machine Co., Milwaukee

HEADS, SLOTTING
Experimental Tool & Die Co., Detroit

HEADS, Tapping
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Bradford Mach. Tool Co., Cincinnati
Cross Gear & Machine Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
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Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.

HEATERS, Rivet
American Gas Furn. Co., Elizabeth, N. J.
General Electric Co., Schenectady, N. Y.

HEATERS, Unit
Buffalo Forge Co., Buffalo, N. Y.
Surface Combustion Corp., Toledo, O.
Wiedemann Machine Co., Philadelphia

HELMETS & SHIELDS, Welding
Air Reduction, N. Y. C.
American Optical Co., Southbridge, Mass.
Harnischfeger Corp., Milwaukee
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland

HOBBERS, Gear
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Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Lees-Bradner Co., Cleveland
Scherr Co., Geo., N. Y. C.

HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Mach. Co., Hartford, Conn.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

HOISTS, Chain
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Ford Chain Block Div., Am. Chain & Cable Co., Philadelphia
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HOISTS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
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Micromatic Hone Corp., Detroit
Norton Co., Worcester, Mass.
Sunnen Products Co., St. Louis, Mo.

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Kropp Forge Co., Chicago
Williams & Co., J. H., Buffalo, N. Y.

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Chicago Metal Hose Corp., Maywood, Ill.

HOSE, Rubber
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

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Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Watson-Stillman Co., Roselle, N. J.

INDEXING FIXTURES (See FIXTURES, Indexing)

INDICATORS, Dial (See GAGES, Dial)

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Instrument Co., Philadelphia
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

INDICATORS, Temperature
Brown Instrument Co., Philadelphia

INSTRUMENTS, Hardness-Measuring
Shore Inst. & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Inst. Co., N. Y. C.

INSTRUMENTS, Optical Inspection
Centerscope Instrument Co., Los Angeles, Calif.
Jones & Lamson Mach. Co., Springfield, Vt.
Portman Mach. Tool Co., Mt. Vernon, N. Y.
Vard, Inc., Pasadena, Calif.

JACKS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

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Cincinnati Bickford Tool Co., Cincinnati
Fosdick Machine Tool Co., Cincinnati
Knight Machinery Co., W. B., St. Louis
Linley Brothers Co., Bridgeport, Conn.
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Reed-Prentice Corp., Worcester, Mass.

JIGS & FIXTURES (See CONTRACT WORK)

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Philadelphia Gear Works, Philadelphia

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General Machinery Corp., Hamilton, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Mitts & Merrill, Saginaw, Mich.
National Machine Tool Co., Cincinnati
Reed-Prentice Corp., Worcester, Mass.

KNIVES, Shear
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Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Works Co., Cleveland
Disston & Sons, Inc., Henry, Philadelphia
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroitt
Niagara Mach. & Tool Wks., Buffalo, N. Y.

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Armstrong Bros. Tool Co., Chicago
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Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

LAPPERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Excello Corp., Detroit
Production Mach. Co., Greenfield, Mass.
Ultra-Lap Mach. Co., Detroit

LAPPERS, Cylindrical & Flat
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Ex-Cell-O Corp., Detroit
Moline Tool Co., Moline, Ill.
Norton Co., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia
Ultra-Lap Mach. Co., Detroit

LAPPERS, Gear
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Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Ultra-Lap Mach. Co., Detroit

LAPS, Toolmaker's
Boyar-Schultz Corp., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
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Producto Mach. Co., Bridgeport, Conn.
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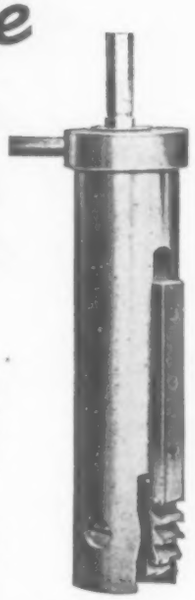

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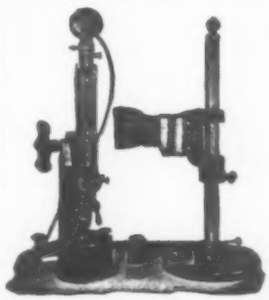

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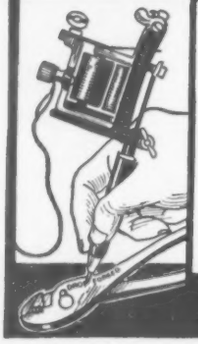

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LATHES, Turret
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Bardons & Oliver, Inc., Cleveland
Bullard Co., Bridgeport, Conn.
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General Machinery Corp., Hamilton, O.
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Warner & Swasey Co., Cleveland

LEVELS, Precision
Brown & Sharpe Mfg. Co., Providence, R. I.
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Universal Boring Mach. Co., Hudson, Mass.

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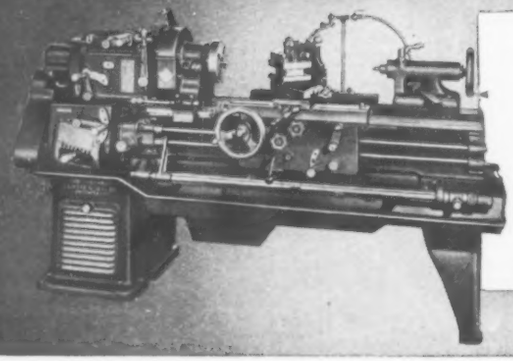

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Scully-Jones & Co., Chicago
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MANDRELS, Solid (See **ARBORS & MANDRELS**)

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Acromark Co., Elizabeth, N. J.
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Mathews & Co., James H., Pittsburgh
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Numberall Stamp & Tool Co., Huguenot Park, N. Y.

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Tolhurst Div., American Machine & Metals, Inc., East Moline, Ill.

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Ryerson & Son, Jos. T., Chicago
Westinghouse Electric & Mfg. Co., E. Pittsburgh

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Davis & Thompson Co., Milwaukee
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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney, Waltham, Mass.
Scherr Co., Inc., George, N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

MICROSCOPES
Scherr Co., Geo., N. Y. C.

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Sundstrand Mach. Tool Co., Rockford, Ill.

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Producto Machine Co., Bridgeport, Conn.

MILLERS, Duplex
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General Machinery Corp., Hamilton, O.
Kearney & Trecker Corp., Milwaukee
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Snyder Tool & Engrg. Co., Detroit
Van Norman Mach. Tool Co., Springfield, Mass.

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Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kent-Owens Machine Co., Toledo, O.
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Nichols & Sons, W. H., Waltham, Mass.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

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Jefferson Mach. Tool Co., Cincinnati
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
Kent-Owens Machine Co., Toledo, O.
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Machinery Mfg. Co., Chicago
Nichols & Sons, W. H., Waltham, Mass.
Ohio Machine Tool Co., Kenton, O.
Producto Machine Co., Bridgeport, Conn.
Sidney Machine Tool Co., Sidney, O.
Van Norman Machine Tool Co., Springfield, Mass.

MILLERS, Planer Type
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Consolidated Mach. Tool Corp., Rochester, N. Y.
Fitchburg Engrg. Corp., Fitchburg, Mass.
General Machinery Corp., Hamilton, O.
Kearney & Trecker Corp., Milwaukee
Sellers & Co., Inc., Wm., Philadelphia

MILLERS, Planetary
Plan-O-Mill Corp., Royal Oak, Mich.

MILLERS, Profile
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Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machinery Co., W. B., St. Louis
Morey Machinery Co., Inc., N. Y. C.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
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Hanson-Whitney Mach. Co., Hartford, Conn.
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Producto Machine Co., Bridgeport, Conn.
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Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Works, Waltham, Mass.

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Blank & Buxton Machy. Co., Jackson, Mich.
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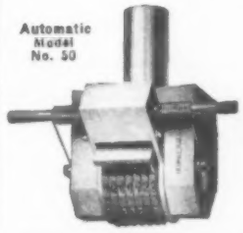

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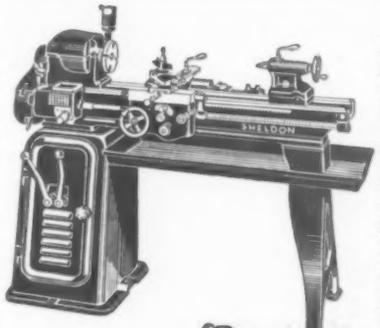

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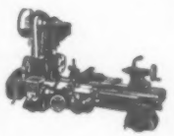

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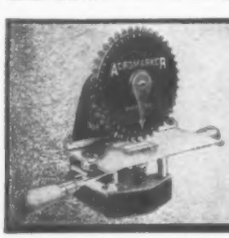

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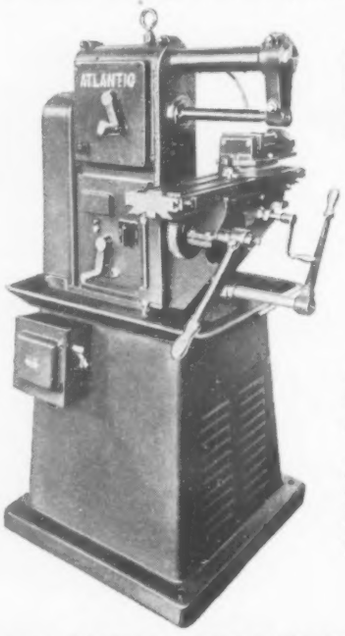

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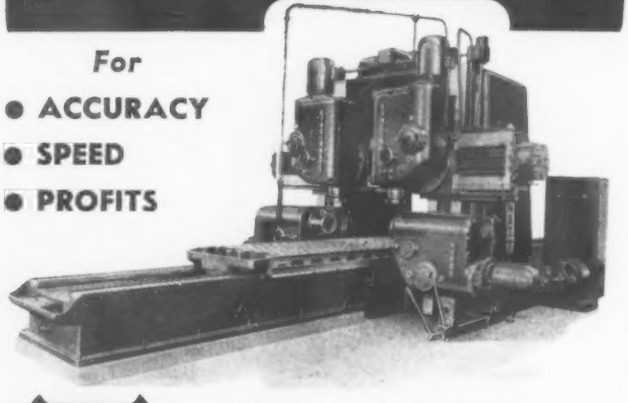

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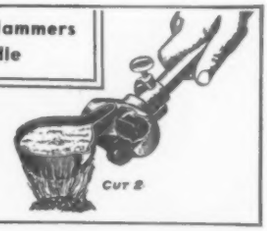

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Nilson Mach. Co., A. H., Bridgeport, Conn.
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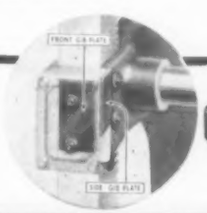

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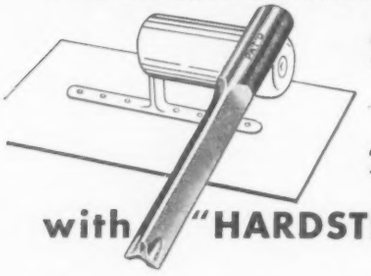

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Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
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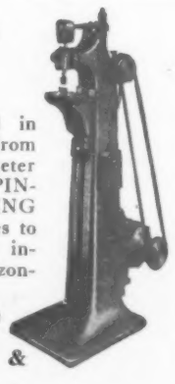

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Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
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Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
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Onsrud Machine Works, Chicago
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Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
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Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

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Ryerson & Son, Inc., Jos. T., Chicago

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National Acme Co., Cleveland
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Lamson & Sessions Co., Cleveland
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
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Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

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American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
Lamson & Sessions Co., Cleveland
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs., Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
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Shakeproof Lock Washer Co., Chicago
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Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
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Starrett Co., L. S., Athol, Mass.

SEALS, Oil
Gits Bros. Mfg. Co., Chicago

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DeLaval Separator Co., N. Y. C.
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Tolhurst Div., American Machine & Metals, Inc., East Moline, Ill.

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Cleveland Punch & Shear Works Co., Cleveland

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Jones & Laughlin Steel Corp., Pittsburgh
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Ryerson & Son, Inc., Jos. T., Chicago
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National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

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Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

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Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

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National Twist Drill & Tool Co., Detroit
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Scully-Jones & Co., Chicago
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Union Twist Drill Co., Athol, Mass.

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General Machinery Corp., Hamilton, O.
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Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

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Ideal Commutator Dresser Co., Chicago

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Danly Machine Specialties, Chicago

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American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown Pa.
Sundstrand Mach. Tool Co., Rockford, Ill

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Moore Mfg. Co., Wm., Chicago
Noble & Westbrook Mfg. Co., East Hartford, Conn.

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

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Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa
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Vanadium Alloys Steel Co., Pittsburgh

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Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
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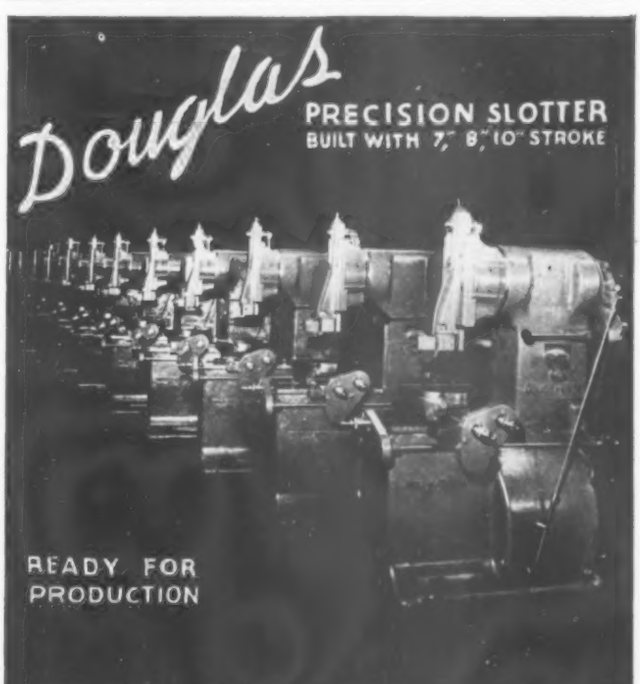

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Wyckoff Drawn Steel Co., Pittsburgh

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Armstrong Bros. Tool Co., Chicago
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Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Crobalt Inc., Ann Arbor, Mich.
Firth-Sterling Steel Co., McKeesport, Pa
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton. O
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

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Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

STRIPPERS, Wire
Ideal Commutator Dresser Co., Chicago

SUB-PRESSES & DIES (See Dies, Subpress)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

SURFACE-BROACHING MACHINES (See BROACHING MACHINES)

SURFACE PLATES (See PLATES, Surface)

SWAGING MACHINES
Etna Machine Co., Toledo
Hardinge Brothers, Inc., Elmira, N. Y.
Torrington Co., Torrington, Conn.

SWITCHES, Electric
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
L-W Chuck Co., Toledo, O.
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y
National Acme Co., Cleveland
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See INDICATORS Speed)

TANKS & CYLINDERS, Air
Anker Holth Mfg. Co. (Airgrip Chuck Div.) Port Huron, Mich.
Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St. Louis
National Tube Co., Pittsburgh
Tomkins-Johnson Co., Jackson, Mich.

TAPER PINS (See PINS, Dowel & Taper)

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TAPPERS, Single & Multi-Spindle
Armstrong-Blum Mfg. Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill
Baush Mach. Tool Co., Springfield, Mass
Bodine Corp., Bridgeport, Conn.
Bradford Mach. Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati-Gilbert Machine Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Etteo Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Haskins Co., R. G. Chicago
Hill Acme Co., Cleveland
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ind.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind
Rickert-Shafer Co., Erie, Pa.
Snyder Tool & Engrg. Co., Detroit

TAPS, Adjustable (See DIES, Adjustable)

TAPS, Hand & Machine, Solid
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.

TESTING EQUIPMENT, Tension & Compression
Baldwin-Southwark Corp., Philadelphia
Hartford Special Machinery Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

THREADING MACHINES, Die-Head
Brown & Sharpe Mfg. Co., Providence, R. I.
Dalzen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Excello Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Lees-Bradner Co., Cleveland
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Wks., Waltham, Mass.
Warner & Swasey Co., Cleveland

For Sensitive Tapping of Precision Work

HAMILTON-MUEHLMATT
SENSITIVE TAPPING MACHINE

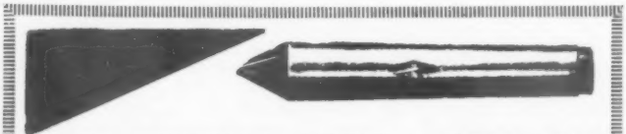
● Here's a high speed, sturdy little tapping machine which is especially adapted to precision tapping of light work. It is now being used very successfully for tapping parts for instruments, cameras, watches, clocks and business machines.

It has gained wide acceptance due to the high quality of work produced because of its particularly smooth operation without breakage of even the finest taps.

Mechanically simple and easy to operate, a man can become expert in an hour or so of operation. Quiet—no noisy reversing mechanism nor slinging of oil. Can be plugged in any light socket. For full information write for bulletin.

PERTINENT DATA
Capacity—From smallest and finest tap to 10-32 inclusive
Power—¼ H.P. 1750 R.P.M. Motor either CI-AC or compound DC
Tapping speeds approx. 1200 to 2600 R.P.M.
Size of machine—16 in. x 7 in. x 22 in. high
Weight—Approx. 60 pounds

The Hamilton Tool Co.
830 NINTH ST. HAMILTON, OHIO



TEN TIMES THE LIFE OF TOOL STEEL CENTERS
because
Red-E centers have high speed steel ends
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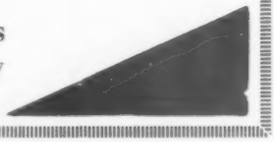

WHERE-TO-BUY DIRECTORY

THREADING MACHINES, Roll
Brown & Sharpe Mfg. Co., Providence, R. I
Hill Acme Co., Cleveland
V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland

TOOL HOLDERS (See **HOLDERS, Tool**)

TOOL POSTS, Lathe
Armstrong Bros. Tool Co., Chicago
Detroit Tap & Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Boring
Armstrong Bros. Tool Co., Chicago
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Heald Machine Co., Worcester, Mass.
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

TOOLS and PARTS, Cemented-Carbide
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit
Crafts Co. Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston and Sons, Inc., Henry, Tacony, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Grayson Mfg. Co., Monrovia, Cal.
Illinois Tool Works, Chicago
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Sheffield Corp., Dayton, O.
Tungsten Elec. Corp., Union City, N. J.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., Chicago
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond-Tipped
Coldset Diamond Tool Co., N. Y. C.
Crafts Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Gorton Machine Co., Geo., Racine, Wis.
Kent-Owens Machine Co., Toledo, O.
Norton Company, Worcester, Mass.
Roselaar, Louis A., N. Y. C.
Smit & Son, J. K., N. Y. C.

TOOLS, Flexible-Shaft
Dumore Co., Racine, Wis.
Haskins Co., R. G., Chicago
Ideal Commutator Dresser Co., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Walker-Turner, Inc., Plainfield, N. J.

TOOLS, Hand
Allen Mfg. Co., Hartford, Conn.
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Atkins & Co., F. C., Indianapolis
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Capewell Mfg. Co., Hartford, Conn.
Carboloy Co., Detroit
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Punch & Shear Works Co., Cleveland
Cleveland Twist Drill Co., Cleveland
Crafts Co., Arthur A., Boston
Dearborn Gage Co., Dearborn, Mich.
Disston & Sons, Inc., Henry, Philadelphia
Elastic Stop Nut Corp., Union, N. J.
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Greene, Tweed & Co., N. Y. C.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hamilton Tool Co., Hamilton, O.
Lufkin Rule Co., Saginaw, Mich.
National Twist Drill & Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
North Bros. Mfg. Co., Philadelphia
Numberall Stamp & Tool Co., Huguenot Park, N. Y.
Plomb Tool Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Racine Tool & Mach. Co., Racine, Wis.
Scully-Jones & Co., Chicago
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Thompson & Son Co., Henry G., New Haven, Conn.
Union Twist Drill Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N Y
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Knurling (See **Knurls & Knurl Holders**)

TOOLS, Lathe, Shaper and Planer
American Tool Works Co., Cincinnati
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn
Blake Co., Edward, Newton Centre, Mass.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Empire Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Illinois Tool Works, Chicago
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Nobur Mfg. Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Starrett Co., L. S., Athol, Mass.
Sturdimatic Tool Co., Detroit
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg. Co., Chicago
Delta Mfg. Co., Milwaukee
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Foredom Electric Co., N. Y. C.
Hisey-Wolf Machine Co., Cincinnati
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

TOOLS, Portable Pneumatic
Cleveland Pneu. Tool Co., Cleveland
Onsrud Machine Works, Inc., Chicago
Rotor Tool Co., Cleveland
Sheldon Machine Co., Chicago

TOOLS, Stellite
Haynes Stellite Co., N. Y. C.

TORCHES, Gas-Cutting & Welding
Air Reduction, N. Y. C.

TRANSMISSIONS, Hydraulic
American Engrg. Co., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Ex-Cell-O Corp., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.

TRANSMISSIONS, Mech. Variable-Speed
Allis-Chalmers Mfg. Co., Milwaukee
Continental Machines, Inc., Minneapolis
Earle Gear & Machine Co., Philadelphia
Ideal Commutator Dresser Co., Chicago
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Columbus, Ind.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

TROLLEYS, TRACKS & TRAMWAYS, Overhead
American Steel & Wire Co., Cleveland
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engineering Co., Wickliffe, O.
Cullen-Friestedt Co., Chicago
Curtis Pneu. Machinery Co., St. Louis
Ford Chain Block Div. Am. Chain & Cable Co., Inc., Philadelphia, Pa.
Harnischfeger Corp., Milwaukee
Mathews Conveyer Co., Ellwood City, Pa.
Standard Conveyor Co., No. St. Paul, Minn.
Wright Mfg. Div. Am. Chain & Cable Co., Inc., York, Pa.

TRUCKS, Hand
Standard Pressed Steel Co., Jenkintown, Pa.

TUBING, Steel
Bissett Steel Co., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Co., Canton, Ohio

TURRETS, Tool-post & Tailstock
Gisholt Machine Co., Madison, Wis.
Jefferson Machine Tool Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Warner & Swasey Co., Cleveland

UNITS, Drilling, Reaming & Tapping
Barnes Co., W. F. & John, Rockford, Ill.
Kingsbury Mach. Tool Corp., Keene, N. H.

UPSETTERS (See **Forging Machines**)

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TANTALUM-TUNGSTEN CARBIDE
CUTTING TOOLS—DRAWING DIES
TANTUNG "G" CUTTING TOOLS

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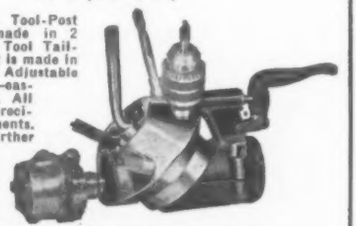
VASCOLOY-RAMET CORPORATION
NORTH CHICAGO, ILLINOIS

DON'T WAIT FOR TURRET LATHES
CONVERT YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS
To fit Bench lathes and lathes up to 24" swing.
Designed to increase production.
15 days delivery.

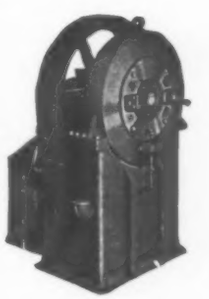
Pat. Pending

The 4 Tool Tool-Post Turret is made in 2 sizes. The 5 Tool Tail-Stock Turret is made in 4 sizes. Also Adjustable Full Feed—easily attached. All tools are precision attachments. Write for further details.



Also — Jefferson Precision Milling Machines, Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.

JEFFERSON MACHINE TOOL CO.
So. Sweeney, Cutter & Fourth Sts. Cincinnati, Ohio



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ROTARY
SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.

WHERE-TO-BUY DIRECTORY

USED MACHINERY (See Searchlight Section)

V BLOCKS (See Blocks, V)

VALVES, Air-Control
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Curtis Pneu. Machinery Co., St. Louis
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Ross Operating Valve Co., Detroit
Schrader's Son, A., Brooklyn, N. Y.
Tompkins-Johnson Co., Jackson, Mich.

VALVES, Hydraulic
Baldwin-Southwark Corp., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Elmes Engrg. Wks., Chas. F., Chicago
Nicholson & Co. W. H., Wilkes-Barre, Pa.
Racine Tool & Mach. Co., Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Watson-Stillman Co., Roselle, N. J.

VERNIERS
Brown & Sharpe Mfg. Co., Providence, R. I.

VISES, Air-Operated
Ross Operating Valve Co., Detroit
Tomkins-Johnson Co., Jackson, Mich.

VISES, Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago Wheel & Mfg. Co., Chicago
Cincinnati Milling Mach. Co., Cincinnati
Cincinnati Planer Co., Cincinnati
Cincinnati Shaper Co., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Desmond-Stephan Mfg. Co., Urbana, O.
Fenn Mfg. Co., Hartford, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Jefferson Mach. Tool Co., Cincinnati
Johnson Tool Co., E. Providence, R. I.
Kearney & Trecker Corp., Milwaukee
Knight Mach. Co., W. B., St. Louis
L-W Chuck Co., Toledo, O.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.

VISES, Machinists' Bench
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Desmond-Stephan Mfg. Co., Urbana, O.
Fenn Mfg. Co., Hartford, Conn.
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
New Britain-Gridley Machine Co., New Britain, Conn. (Stands)
North Bros. Mfg. Co., Philadelphia
Wiedemann Machine Co., Philadelphia

VISES, Pipe
Armstrong Bros. Tool Co., Chicago
Desmond-Stephan Mfg. Co., Urbana, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

WASHING & DRYING, Machines (See METAL-CLEANING EQUIPMENT)

WELDERS, Arc
Air Reduction, N. Y. C.
Allis-Chalmers Mfg. Co., Milwaukee
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland
Trindl Products Ltd., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

WELDERS, Resistance
Ohio Machine Tool Co., Kenton, O.

WELDERS, Spot
Ohio Machine Tool Co., Kenton, O.
Progressive Welder Co., Detroit

WELDING ACCESSORIES
Clark Controller Co., Cleveland
Cullen-Friestedt Co., Chicago
Lincoln Electric Co., Cleveland
Mallory & Co., Inc., P. R., Indianapolis (Electrode Holders)

WELDING CONTROLS
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland

WELDING EQUIPMENT
Bayard & Co., Inc., M. L., Philadelphia
General Electric Co., Schenectady, N. Y.

WELDING POSITIONERS
Cullen-Friestedt Co., Chicago

WELDING RODS
Air Reduction, N. Y. C.
Allegheny-Ludlum Steel Corp., Pittsburgh
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland
Atkins & Co., E. C., Indianapolis
Harnischfeger Corp., Milwaukee
Haynes Stellite Co., N. Y. C.
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland
McKay Co., Pittsburgh
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Revere Copper & Brass Corp., N. Y. C.
Roebling's Sons Co., John A., Trenton N. J.
Ryerson & Son, Inc., Jos. T., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

WELDING TIMERS
Lincoln Electric Co., Cleveland

WELDING TIPS
Mallory & Co., Inc., P. R., Indianapolis

WHEELS, Grinding & Polishing
Bakelite Corp., N. Y. C.
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Mach. Co., Cambridge, Mass
Bridgeport Safety Emery Wheel Co. Bridgeport, Conn.
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Cincinnati Milling Mach. Co., Cincinnati
deSanno & Son, Inc., A. P., Phoenixville, Pa.
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Midwest Abrasive Co., Detroit
Norton Co., Worcester, Mass.
Porter-Cable Mach. Co., Syracuse, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.
Sterling Grinding Wheel Co., Tiffin, O.
Vitrified Wheel Co., Westfield, Mass.

WINDERS, Coil
Ideal Commutator Dresser Co., Chicago

WIRE, Spring
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh
Page Steel & Wire Div. Amer. Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper & Brass Inc., N. Y. C.

WIRES, Measuring
Greenfield Tap & Die Corp., Greenfield, Mass
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

WOODWORKING MACHINERY
Barnes Co., W. F. & John, Rockford, Ill.
Capewell Mfg. Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Diehl Mach. Wks., G. M., Wabash, Ind
Greenlee Bros. & Co., Rockford, Ill.
Jefferson Mach. Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Plainfield, N. J.

WRENCHES, Open End
Armstrong Bros. Tool Co., Chicago
Plomb Tool Co., Los Angeles
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Pipe
Armstrong Bros. Tool Co., Chicago
Standard Tool Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Ratchet
Allen Mfg. Co., Hartford, Conn.
North Bros. Mfg. Co., Philadelphia
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Socket
Armstrong Bros. Tool Co., Chicago
Greene, Tweed & Co., N. Y. C.
Plomb Tool Co., Los Angeles
Williams & Co., J. H. Buffalo, N. Y.

WRENCHES, Tap
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Errington Mech. Lab., Stapleton, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

Keeping WAR PRODUCTION Moving

DESMOND DRESSERS and CUTTERS

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DESMOND-dressed grinding wheels cut faster . . . last longer . . . keep production on the move. In plants throughout the country, you'll find these superior tools doing their part. With the only *complete* line of Dressers and Cutters, *DESMOND can meet your needs*—all types and sizes. Get them from your distributor—write for his name.

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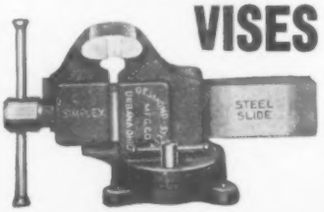

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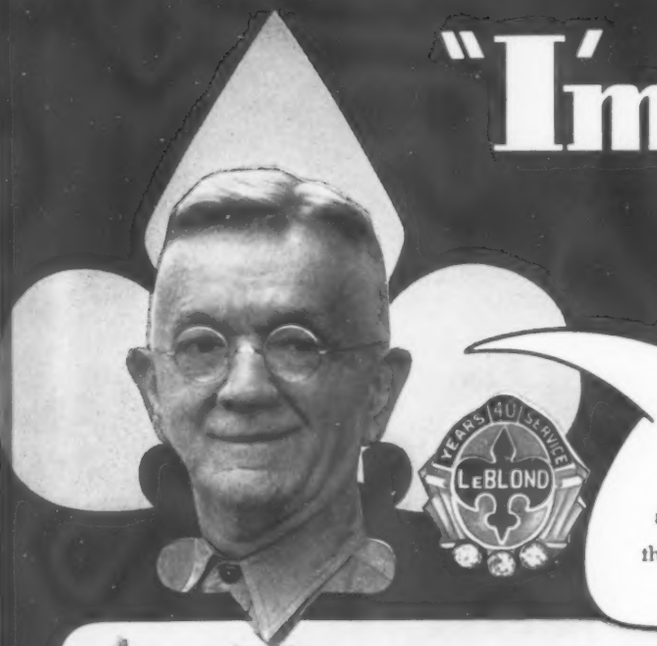
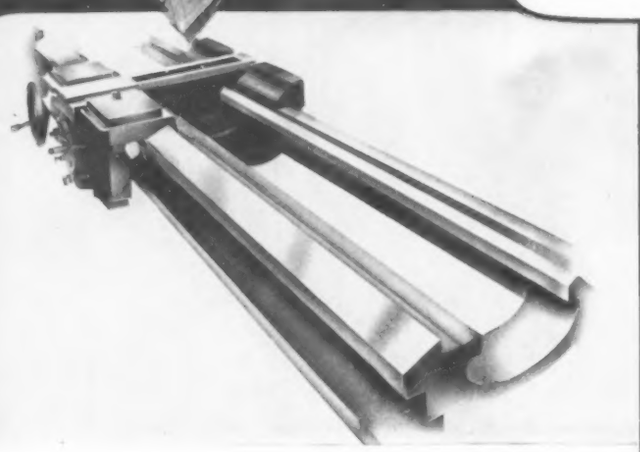
"I'm Tellin' You.."



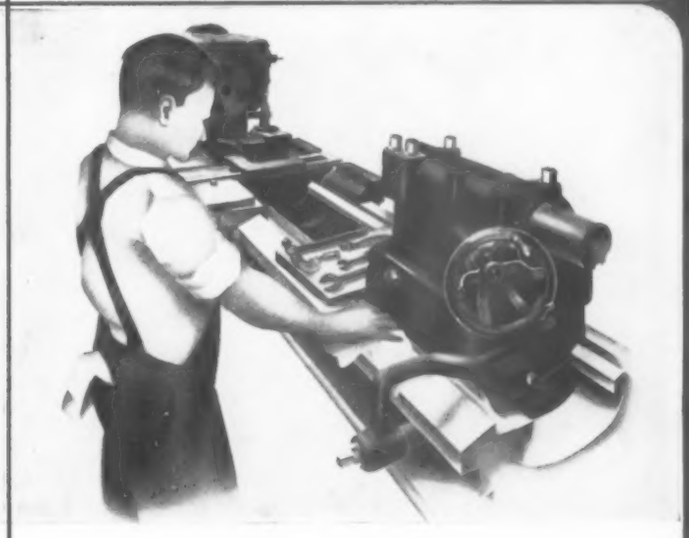
Seeing as how I've been helping to build LeBlond Lathes for 40 years now, the boss figured I ought to have a few ideas about how to take care of them. So I'm supposed to spout off a little to you fellows who are running them to help you "Keep 'em Turning". I've got a pet theory that I can pretty well size up a lathe operator with just a quick look at the bed and carriage of the lathe he has been running . . .



When a *LeBlond Lathe* . . .
leaves our plant, the bed looks like this – all accurately scraped and polished.

But if the operator plays the "Village Blacksmith", using the bed or carriage for an anvil to drive mandrels in and out, and if he uses it as a rack for hammers, wrenches and chucks . . .

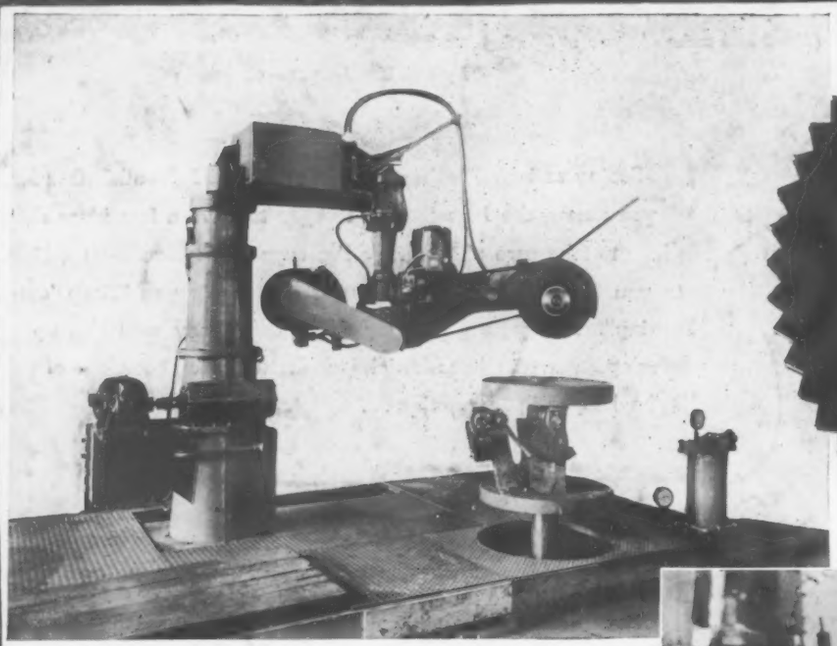
. . . it won't be long before he pounds out the accuracy or wrecks the lathe by feeding the carriage against an obstacle lying between the carriage and headstock.

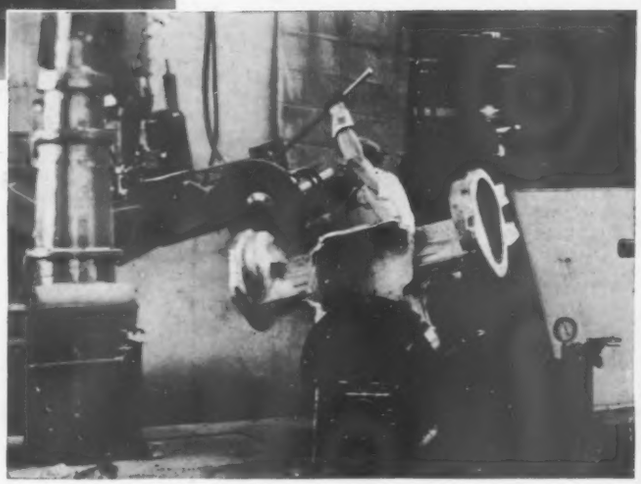


The smart operator has a board at the tailstock end for his tools. He keeps the bed free of heavy turnings and wipes the shears clean with oil. Easy things to remember, but mighty important.

The R. K. LeBlond Machine Tool Co.

CINCINNATI, OHIO





World's largest Universal Abrasive Cut-off Machine equipped with Timken Bearings on motor countershaft, wheel spindle and universal motion of spindle frame. Designed and manufactured by Tabor Manufacturing Company, Philadelphia, Pa.

The biggest production job American Industry ever has been called upon to do finds Timken Bearing Equipped machines of all kinds carrying an overwhelming part of the burden.

Some of these machines contain more Timken Bearings than others, and for that reason are able to operate faster, possess greater precision and endurance.

A few Timken Tapered Roller Bearings are better than none in any machine, but if you want all the advantages these bearings can give, you must have them at every bearing position. Then the threats of friction; wear; radial, thrust and combined loads; and misalignment of moving parts will be turned back for good.

This is a valuable point for every machine designer, manufacturer and user to remember.

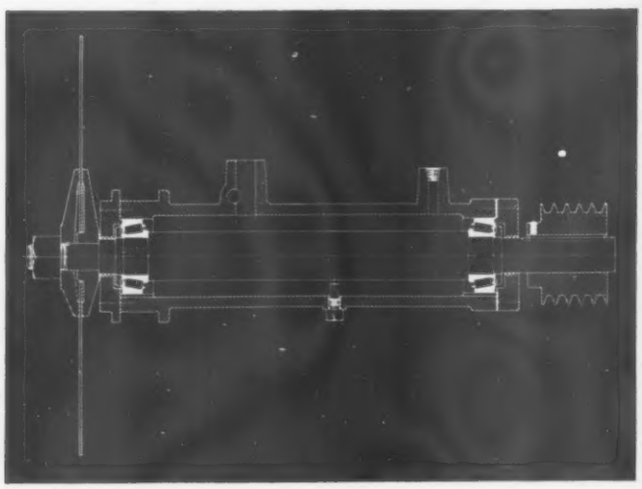
THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.



Application of Timken Bearings to the cutting wheel spindle of the Tabor Universal Abrasive Cut-off Machine.